Radio Control
CAR ACTION
47380
THE WORLD'S LEADING R/C CAR MAGAZINE
March 1995

MORE HORSEPOWER!
COMM DROP COMPARO

HOT Motor Special

- HOW MOTORS WORK
- PICKING THE RIGHT MOTOR
- TRICK REBUILDING TIPS
- BRUSH SELECTION AND MORE! Page 88

Where's Kinwaldo?
Exclusive interview with the champ!

It's FAST, it's TOUGH, it's CHEAP!
Associated's RC10ST

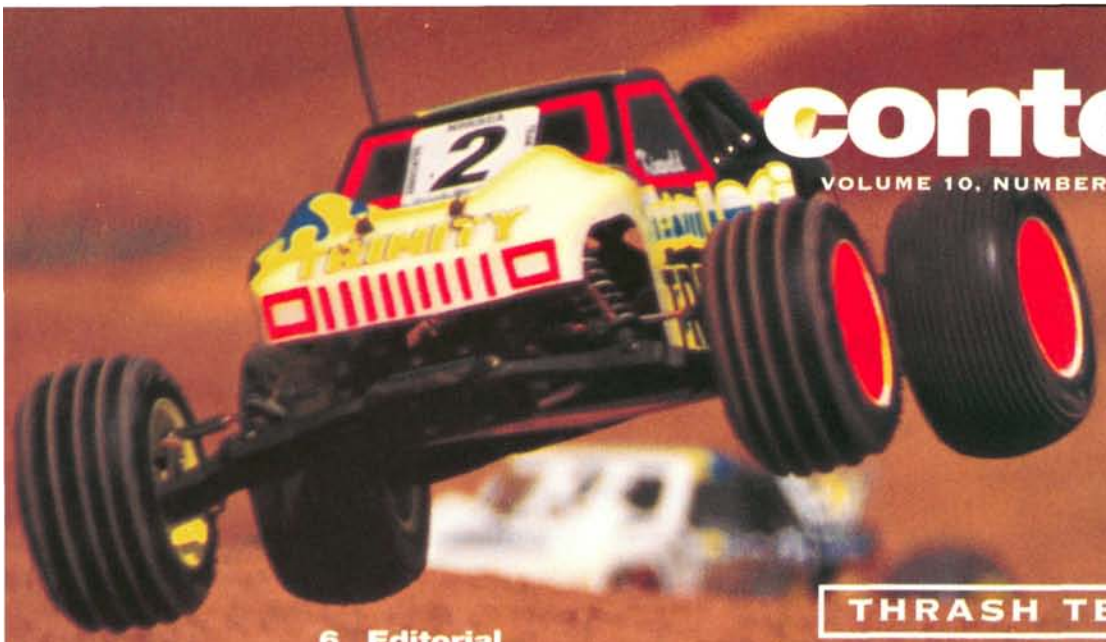
USA $4.50 CANADA $5.50

03>
UPC 0 71896 47380 3

Tested:
NOVAK Hammer Pro ESC
MIP CVD drive shafts
TRAXXAS Stampede monster truck
KYOSHO Porsche 911

contents

VOLUME 10, NUMBER 3 • MARCH 1995



ON THE COVER: photo by Walter Sidas. This page: photo by George Gonzalez.

Those maddening motors

WHAT IS IT about selecting a motor for your R/C car that's so difficult? Well, for an experienced car hobbyist, it's not that big a deal; but for those of you who don't know all there is to know about motors, it can be a confusing subject. When I first got into the hobby, this was about the extent of my motor inquisition when I talked to my local hobby shop owner:

"Is this a fast motor?"

"Yes."

"A really fast motor?"

"It'll make your car do wheelies like silly."

"Well, then, sign me up!"

Yep, that was about it. I'd put that crazy-sick, 9-turn single, drag motor into my Tamiya Frog, nail the throttle and watch and listen as my half-shafts and transmission exploded and turned to dust; then I'd sit back and wonder what the heck just happened! Well, after a while, I learned a little more about motors (through trial and error), and I found that certain motors apply to certain applications, and blah, blah, blah; you get the idea. So those of you who don't want to waste your time—and more important, your money—finding out which motor is best for you, you've come to the right place. In this issue, we've compiled a really cool feature that gives you the complete rundown on motors; it also includes a ton of hot tips on how to properly choose and rebuild your motor.

But one killer feature alone does not make a good magazine, so we have a ton of others: a revealing interview with off-road IFMAR World Champ Brian Kinwald (How does he go so fast?) and three comprehensive Thrash Tests. Toss in some really hot racing action and some cool product reviews, and you've got the makings of a kickin' issue. So sit back, enjoy the ride, and let us know what you think.

John Howell

We want to hear from you! Write, fax, or e-mail us over the Internet: Car Action, Air Age Publishing, 251 Danbury Rd., Wilton, CT 06897; fax: (203) 762-9803; e-mail: Chris Chianelli—chrisc@airage.com; John Howell (Doog)—johnh@airage.com; John Huber—jhuber@airage.com; Frank Masi—frankm@airage.com.

Radio Control CAR ACTION

Group Publisher	LOUIS V. DeFRANCESCO JR.
Publishers	DR. LOUIS V. DeFRANCESCO YVONNE M. DeFRANCESCO
Associate Publisher	GARY DOLZALL
Group Editor-in-Chief	TOM ATWOOD
Senior Editor	CHRIS CHIANELLI
Editor	JOHN HOWELL
Associate Editor	JOHN HUBER
Technical Editor	FRANK MASI
Copy Director	LYNNE SEWELL
Senior Copy Editor	KATHERINE TOLLIVER
Special Publications Manager	KAREN J. HUBER
Managing Art Director	ALAN J. PALERMO
Art Director	BETTY K. NERO
Graphic Artists	ROBIN DEMOUGEOT MICHAEL BOUSE
Staff Photographer	WALTER SIDAS
Systems Manager	GORDON OPPENHEIMER
Director of Marketing	GARY DOLZALL
Circulation Manager	JEAN BINGHAM ABBOTT
Marketing Manager	MICHELLE HAMILTON
Production Manager	MARY REID McELWEE
Production Assistant	ARLENE MELKO
Advertising Manager	SHARON WARNER
Advertising Account Executives	SHELLEY BYINGTON JILL E. SHERTER JILL ELLEN MOLINARO JENNIFER IZZO
Advertising Traffic Coordinator	ELISE SILKOWSKI

SUBSCRIPTION PRICES:
U.S. & Possessions (including APO & FPO): 1 year (12 issues), $29.95; 2 years (24 issues), $54.95. Canada: 1 year, $45.96; 2 years, $86.62 (includes G.S.T.). Elsewhere: 1 year, $42.95; 2 years, $80.95. Payment in U.S. funds. Single-copy prices: $4.50 (USA); $5.50 (Canada). Canadian G.S.T. number R130754872.

RADIO CONTROL CAR ACTION (ISSN 0886-1609, USPS 001-087) is published monthly by Air Age, Inc., 251 Danbury Rd., Wilton, CT 06897, USA. Connecticut Editorial and Business Office, 251 Danbury Rd., Wilton, CT 06897. Phone: 203-834-2900. FAX: 203-762-9803. Michael F. Doyle, Chief Executive Officer; Y.P. Johnson, President; G.E. DeFrancesco, Vice President; L.V. DeFrancesco, Secretary; Yvonne M. DeFrancesco, Treasurer. Second Class Postage Permit paid at Wilton, Connecticut, and additional Mailing Offices.

CONTRIBUTIONS: All materials published in *Radio Control Car Action* become the exclusive property of Air Age, Inc., unless prior arrangement is made in writing with the Publisher. The Publisher assumes no responsibility for unsolicited material. Only material accompanied by a SASE will be returned.

ADVERTISING: Advertising rates available on request. Please send advertising materials, insertion orders, etc., to *Radio Control Car Action*, Advertising Dept., Air Age, Inc., 251 Danbury Rd., Wilton, CT 06897. Phone: 203- 834-2900. FAX: 203-762-9803.

CHANGE OF ADDRESS: Don't miss any issues! Send your new address to *Radio Control Car Action*, Subscription Dept., P.O. Box 427, Mount Morris, IL 61054, six weeks before you move. Include the address label from a recent issue, or print the information exactly as shown on the label. The Post Office will not forward copies unless you provide extra postage. Duplicate issues cannot be sent.

POSTMASTER: Please send Form 3579 to *Radio Control Car Action*, P.O. Box 427, Mount Morris, IL 61054.

Member Audit Bureau of Circulations
PRINTED IN THE USA

ILLUSTRATION BY SCOTT ANGLE

LETTERS

WHICH TRUCK IS FOR ME?

Right now, I'm very confused. I want to get started in this great hobby but I don't know which truck to buy. I can't spend more than $250. I've narrowed my choices down to: the RC10ST, the Stadium Blitzer, the Hawk 2 RTR and the Junior 2. Which is the easiest to build and upgrade?; which performs best?; which is the most race-worthy?; which accessories can I get with it for $250 or a little more?; which one would *you* buy?
GEORGE COLE
Sugarland, TX

Buy the RC10ST, George; here's why. It's relatively easy to build, and most important, it can be upgraded to Team Truck status by adding a few parts. In my opinion, it's your best bet. The truck is competitive out of the box, and it's the best one for racing because of the "upgradability" factor. The other trucks are good, but you'd spend more to get them up to the RC10ST's level.

If I were you, I'd buy the truck, an inexpensive AM radio system such as the JR Propo Python or Airtronics Rival and—eventually—a good sport ESC such as Novak's 410 M5 or Racer, or Tekin's 408S to replace the kit's mechanical one. Now, the ESC will cost in the neighborhood of $60, and my suggestions total approximately $240; and we haven't even got you a charger and battery pack yet! If you can wait, use the kit's mechanical speed control (which really isn't that bad) and get yourself a decent AC/DC charger and a battery pack or two. Good luck, and have fun. *—Doogie*

WRITE TO US! We welcome your photos, drawings, comments and suggestions. Letters should be addressed to "Letters," Radio Control Car Action, 251 Danbury Rd., Wilton, CT 06897-3035. Letters may be edited for clarity and brevity, and each must include a full name and address or telephone number so that the identity of the sender can be verified. We regret that, owing to the tremendous numbers of letters we receive, we can't respond to every one.

INTERNET ADDRESSES:
John Howell: johnh@airage.com.
Chris Chianelli: chrisc@airage.com.
John Huber: jhuber@airage.com.

ANOTHER TRUCKER

Help! I plan to buy an R/C truck, but I can't choose between the Team Losi Double-XT and the Associated RC10T Team Truck. What do you think? I'm also having trouble choosing an ESC. Do you have any suggestions in the $60 to $160 price range?
MARIO RAMIREZ
Albuquerque, NM

Mario, I know it sounds like a total cop-out, but both are capable of taking you to the winners' circle. Because they're equally competitive, why don't you try to find some features that might make one in particular a better buy for you.

Assuming that you plan to race your truck and that you can deal with its price, I recommend a racing-style ESC such as the Novak Hammer Pro and the Tekin TSC G-12. They're in the same price range—anywhere from $100 to $115. Good luck with your decisions. *—Doogie*

YET ANOTHER TRUCKER

I plan to buy a Kyosho USA-1, and I have a few questions: is the USA-1 faster than the Clod Buster, and does it handle better than it? Also, I read the July '94 issue's, "Project Big Truck," and I'm wondering whether I can use the 6-cell 4000mAh battery pack for the USA-1. Are hop-ups like an aluminum chassis and aluminum gearboxes available? Will sand damage the USA-1? Last but not least, you have a great magazine. Keep up the good work!
RANDY MORICHIKA
Mililani, HI

Well Randy, first, thanks for the compliment. Now, to answer your questions: the USA-1 does handle slightly better than the Tamiya Clod Buster, but not much better. If you intend to modify your truck extensively with a ton of aftermarket hop-ups, you might want to consider buying a Clod, because there are tons more parts available. I'm not too sure whether there are any hop-up parts for the USA-1. Don't worry about sand damaging your truck—unless, of course, you're talking about beach sand (you live in Hawaii—right?).

LETTERS

Beach sand contains salt, and it tends to be slightly corrosive after a while. In any sandy situation though, you should always get into the habit of keeping your R/C car or truck relatively clean. You should be able to use the batteries you specified. All you have to do is find room in the chassis for those huge cells. ***—Doogie***

CALENDAR QUESTIONS

I'm sure you've seen calendars that feature a full-size sports car every month. Why doesn't *R/C Car Action* do the same?—R/C cars and trucks, of course. It would be great to have large pictures of my many favorite cars with their scale dimensions shown underneath. I'd buy such a calendar, and I bet other R/C enthusiasts would, too! Give it some thought. I love your magazine. Keep up the good work!
ERIC GOLUBIC
Canfield, OH

Well Eric, I hate to tell you this, but it's not gonna happen at this time. A lot of time and planning has to go into such a project, and right now, we're concentrating all our efforts on making this mag the best R/C car mag in the world. Here's a suggestion though: get yourself a calendar and all your past issues of Car Action, then cut out pictures of your favorite machines and paste them over the calendar artwork! Yeah, yeah; I know it's a lame solution, but I guess it's better than nothing. ***—Doogie***

HE'S BACK...

I'm very impressed with your magazine; the information is great! A couple of years back, I raced R/C electrics, and I had the Blackfoot from hell! (I spent over $1,000 on it.) I'm considering getting back into racing. What's a good, inexpensive truck to start with? I'd really appreciate your input.
MIKE (WEASEL) CRANER
Salt Lake City, UT

What's up, Weasel? Man, I totally remember the days of putting around a grand into the old 'Foot myself. I had every Thorp, CRP, JG, blah, blah, blah hop-up that you could think of. I was totally into fixing up my Blackfoot. It was a blast! It still didn't handle nearly as well as today's trucks, but it was a ton of fun. Anyway, I'll tell you the same thing I told another reader about getting a new race truck. Look back at his letter, and then go from there (see "Which Truck is for Me?"). If you can handle a little more than the $250 budget that reader is on, then I recommend that you look at these four race trucks: Team Losi's Double-XT, Team Associated's RC10T (the Team Truck, not the bushing version I recommended earlier), the Traxxas SRT and the Schumacher Storm 2000. They're all really good and capable of winning A-Mains; plus, as a bonus, you won't have to put a ton of money into making your truck capable of getting around a track in one piece. Out of the box, today's racing trucks don't need too much to be competitive against what the top factory guys are driving. Good luck, and welcome back. ***—Doogie***

WAY TOO FAST

Help! I'm about to buy a Tamiya Benetton Ford B192, and I want it to be really fast. I'm thinking of using an Onyx Trinity 14 double machine-wound modified motor. Will it fit? Is it fast? If it isn't, can you recommend one that will make my car really fast?
JOE SYLVESTER
Glen Gardner, NJ

Sure, the Onyx motor will fit the Benetton F1, and yes, Joe, it is very fast. It might be a bit too fast for your application though. I've used that motor in an F1 car and it was just too much for it! It was definitely fun to drive, but the car spun out too easily. If you have your heart set on this motor, though, I recommend that when you set up your speed control, set it so that you won't get full power when you grab a handful of throttle (this only applies to ESC's with torque limiters). You'll want this car to roll off the line with as little wheelspin as possible. If you don't set it up that way, chances are it will just sit there and do donuts all day. In all honesty, your safest bet is to go with a stock motor; your car will be much easier to drive. ***—Doogie***

READER'S rides

PAPER POWER

Ken Billings of San Miguel, NM, sent us a photo of this interesting ride—a 1925 Ford Model T. Ken hand-cut the body out of an unusual material—poster board! He tells us that poster-board bodies are extremely easy and inexpensive to make, but they still look great pounding down the track, along the street or just about anywhere you can drive them. One word of caution: if you crash or roll, you wrinkle! Do they make Bondo™ for cardboard, or does he use papier maché?

TERRIFIC TWOSOME

D.J. Clark of Deming, NM, sent us this photo of his two Traxxas rides—the TRX-1 and the Blue Eagle LS-II. Both are controlled by a Futaba Magnum Junior radio, Futaba 9301 servos and Novak 410 M-5 ESCs, and they're powered by hand-wound Motor Man modified motors and Trinity 1700 SCRCs. If you're wondering about the cool paint jobs, they were airbrushed by D.J. and his best friend, Jeff. You can catch D.J.'s R/Cs in action at the Las Cruces R/C Racing Association track in Las Cruces, CA, where he says he "plays hard and races harder"!

MOUNTAIN CLIMBER

Here's a peek at Richard Whitaker's Kyosho USA-1. Richard, who lives in the mountains of Brookings, OR, modified his USA-1 with a full set of ball bearings, eight Kyosho Gold shocks, Tecnacraft titanium tie rods, Thorp hubs, ball diffs and telescopic drive shafts, a Novak 610RV ESC and Trinity Monster Mash motors. Richard scratch-built the skidplate, the wheelie bar and the steering blocks out of aluminum. The truck uses a Futaba 9301 servo for steering, and it's controlled by a Futaba Magnum Junior radio. Parma's Grave Digger body tops it all off. Well, Richard, you have all those hills in your backyard to conquer, and all we can say is that you're a lucky guy.

TRUCK? WHAT TRUCK?

This demonstration of power comes from Stephen Malfatti of San Ramon, CA. He has decked out his Traxxas Sledgehammer with ball bearings, a modified motor, a 6-cell, 1500 SCR Sanyo pack and a DuraTrax ESC. Controlled by an Airtronics XL2P radio, Stephen tells us this truck is virtually indestructible. Looks like the little green truck wasn't quite as lucky.

"Readers' Rides" is our way of recognizing the unique, innovative—and sometimes bizarre!—vehicles that our readers have created. Send us a sharp, uncluttered, well-exposed color photo of your car or truck (no Polaroids, please!), along with a brief description, to Readers' Rides, R/C Car Action, 251 Danbury Rd., Wilton, CT 06897. If the Ayatollah of Radio Controlla chooses your photo, you'll receive a 6-month subscription to Car Action, or an extension of your existing subscription. You'll also be eligible for the fourth annual "Reader's Ride of the Year Contest" in the fall of 1995. Write your address and phone number on your letter and on the back of each photo you send, in case we need to contact you.

READER'S rides

A NEW CHALLENGER?

This interesting-looking R/C car comes from Wes Jang of San Francisco, CA. What is it, you ask?—an Inferno 10?— a Pirate 10? Nope; it's a Panda Challenger 2000. Yes, that's right; it's a Panda car! Wes bought it for $200 while on a trip to Taiwan (unfortunately, it's not currently sold in the U.S.). It comes stock with a lot of hot items: a powerful .12BX engine, hard-anodized shocks, full ball bearings, three diffs, a disk brake and a sturdy chassis made of upper and lower aluminum plates (which make the car very stiff and allow it to perform well in the rough stuff). Wes went one step further and modified his car with Team Associated 2.2 wheels and tires, stiffer shock springs, a heat-sink head and a tuned pipe. A little engine work helps it to get up and go a little more quickly. It's really cool, Wes. We're just bummin' that it isn't available here because, somehow, some way, we're gonna have to get our hands on one, too!

SIGNING OFF

Mark Lengerich, co-owner of the RC Barn in Monroe, IN, sent in this shot of his four favorite RCs—his Associated RC10 Team Car, Associated RC10T, Losi/DuraTrax gas conversion truck and Reflex 10 sprint car. His vehicles all have Novak electronics, Futaba radios and Losi and Pro-Line tires, and they all sport his "almost-famous," signature paint job. But he's especially proud of the truly famous signatures found on his RC10T, which has been autographed by Brian Kinwald, Jack Johnson and Gil Losi.

TEXAS TORNADO

Brian Holder—a senior at West Wood High School in Austin, TX—admits that he spends most of his paychecks on his R/C cars. His latest acquisition is this RC10GT Team Truck, which sports an awesome paint job done by Brian himself. The GT is powered by a TNT .12 engine and piloted by a KO Propo EX-10. Brian has modified his ride with Lunsford titanium tie rods and RPM rod ends. He proudly tells us that his RC10GT has taken his local track by storm by claiming first place almost every time he races.

ROCK WARRIOR

This hot-looking Clod Buster is the work of Dave Grasenick of Gurnee, IL, and it's his very first R/C vehicle. It's equipped with a Parma Hemi engine, RAm fog lights and many ESP mods—aluminum body mounts, chrome wheels, stainless-steel bearings, a headlight kit, suspension lift kit, twin-tube rear and lower

bumpers and an aluminum skid-plate. Dave plans to further modify his Clod Buster with oil-filled shocks, aluminum wheels and upgraded motors. Good job, Dave!

SPEEDWAY T

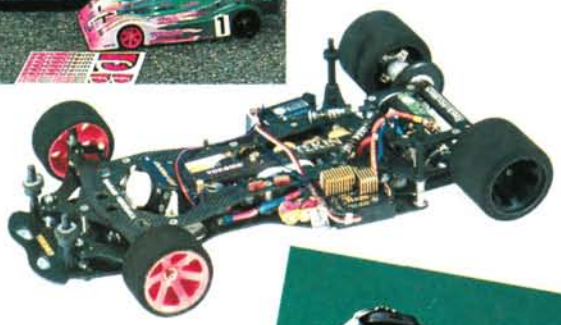
This highly modified Team Associated RC10T belongs to Victor Hernandez of Miami, FL. He races it at Andy's R/C Speedway in Kendal, FL, where he has won a few trophies in truck-class A-Mains. It has a Reedy Sonic 12-turn modified motor, a Novak HPc ESC, an RPM 2.65 gear-reduction unit (equipped with Team Losi's Hydra Drive), RPM suspension arms, a graphite chassis, Sanyo 1700 SCRCs, HPI wheels and foam truck tires (not shown), 0-degree rear hub carriers and an A&L Slam-It lower body that he airbrushed himself. It looks good, Victor, but we're concerned about your driver of choice!

In search of fun and glory, cause life's too short to be a sheep • by Chris Chianelli

INSIDE scoop

Protoform bodies conquer the Worlds

Using Protoform's slippery 1/10-scale P-35 Nissan, Masami Hirosaka won the '94 IFMAR Pro-10 World Championships (held in Germany). This was the second 1/10-scale on-road World Championship ever held. (The first was at the Ranch, in California, and it was won by Joel Johnson and the then-new Trinity EV10). Also shown is the prototype Yokomo YRX-10 1/10-scale on-road chassis Masami used to win the crown. We'll have a review on this car as soon as we get one. In other Worlds news, six of the top 10 bodies at the '94 IFMAR 1/12-Scale Worlds (held in France) were Protoform's Nissan bodies. Protoform's doing something right!



NEW COMPANY HITS HARD

For a company that has been on the racing scene for just a little more than seven months, MAXTEC has accomplished quite a lot. According to a recent bulletin from MAXTEC, Associated drivers Barry Baker and Brent Wallace and Losi driver Jeremy Kortz have switched to MAXTEC motors. Barry's first MAXTEC-powered win was at the NORRCA Road Course Nationals, where he TQ'd and won the 1/10-scale Expert Modified class by nearly half a lap over Reedy driver Kevin Jelich, HPI/Kisbey driver David Potter and three-time world champ Tony Neisinger. In addition, Paul Cathy won in Expert Stock using the MAXTEC 36-degree pink stock motor. Two other MAXTEC drivers also qualified for the Stock A-Main event. We'll be keeping our eyes on these guys.

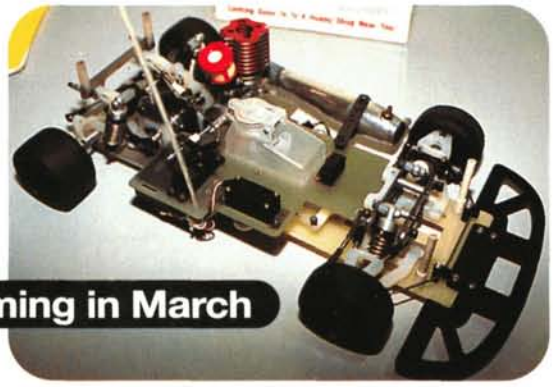
Championship Series Cells

It's no secret: you can spend a small fortune on batteries. Many feel that the high-speed oval scene is a race waged by high-cost batteries and battery charging and cycling equipment. With the solution to this in mind, Tamiya has introduced the Official Tamiya R/C Championship Series "Racing Battery" to ensure all contestants are on equal ground at Tamiya's events. This handout pack comprises six Sanyo 1400 SCR cells. Tamiya has been doing the "parking lot" thing for years now in Japan and Europe. We could all learn a thing or two from them.

Wraparound Performance

While JR's new Python AM radio is perfect for newcomers, it also has two great features not found on other similarly priced radios: fully adjustable steering dual rate (with a dial conveniently located for thumb operation) and a built-in charge jack for Ni-Cd operation. The all-new Python transmitter features super-comfortable "biocurve" wrap-around styling that greatly aids driver concentration. Also included are an NER-101 mini-receiver, BEC circuitry, NER-510 servos and servo-reversing. Here's the best part—retail $99.95.

INSIDE scoop



Coming in March

Designed by full-scale-oval racer Leonard Wood, TRC's new LW-10 has two years of Wood's R&D expertise poured into it, and it has some of his full-scale chassis design and adjustment "secrets." Its features include: fully independent front suspension (using upper and lower A-arms with adjustable caster and camber); independent rear suspension (using trailing arms); fully adjustable rear panhard bar (to control weight distribution); a belt drive; a central ball diff; a quick-fill 75cc fuel tank; G-10 chassis; and a radio tray—plus aluminum, oil-filled, coil-over shocks all around. The LW-10 can be set up for oval or roadcourse racing. Contact TRC Inc., P.O. Box 1058, Ablemarle, NC 28002.; (704) 982-0507; fax (704) 982-0672.

Precious Memory

Here's the latest from KO Propo—the new EX-I Precious, which boasts a six-model memory. I don't have much on this radio now, but I can tell you it features selectable PCM or PPM (FM), electronic trims, complete exponential and end-point capability and—get this!—lap navigation, traction control, steering speed control, rapid-start and throttle-punch functions. I'll have to get back to you later on the last few.

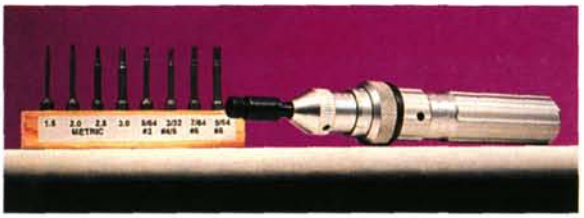
SNEAK PEEK

Hovering Anyone?

I often hear car fanatics saying, "I'd like to try an electric helicopter for a change of pace." Great Planes' new HyperFly might be the perfect distraction. Not only is it affordable, but it's also electrically powered and relatively easy to learn to fly, and it can be assembled at a leisurely pace in one day with tools car modelers already have at hand.

The HyperFly's gear train is very basic and easy to understand. There's no tail rotor. A clear plastic undercambered plate prevents side-to-side tail movement in forward flight. The entire drive system, including a LeMans AP29, is factory-installed. No special servos are required. The servo mount holds standard-size servos, but it can be adjusted to accept lighter mini- or micro-servos. Unlike other helis, the fixed-pitch, 33.5-inch rotor doesn't require complex tracking or pitch adjustments. A special "landing cutoff switch" automatically shuts down the motor for smooth, safe touchdowns. HyperFly is the perfect vacation R/C model. It's quiet and it will fit in a standard car trunk. It requires a 2-channel radio (aircraft frequency) with servos, a 7.2V 1,000mAh Ni-Cd battery and a charger. Watch for our upcoming review in *Car Action* this summer.

Here's Tamiya's new 1/10-scale ProMarket Mercedes-Benz. This latest sedan addition features Tamiya's new TA02W (wide) chassis. I'll have more next month.... *I promise!*

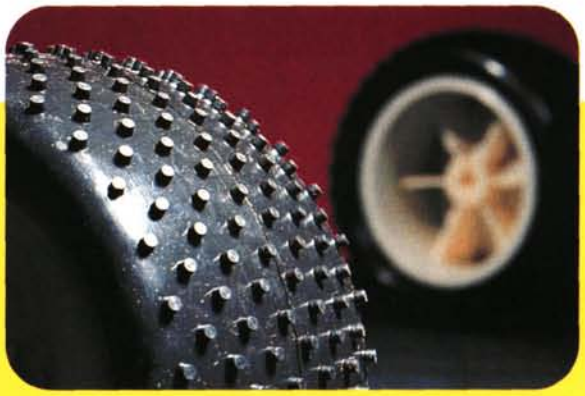


Torque It!

Ever hear someone cry after he has stripped the threads out of a crankcase on an expensive glow engine by over-tightening the head bolts? It's a pathetic sound. I've also seen heads ruined when people crank down too hard on the glow plug.

Just like those on a full-scale engine, the heads on our glow engines should be torqued equally to protect against cylinder-sleeve warp. If you're serious about glow-engine care and maintenance, you should look at JS Technology's Tork It Model 36 screwdriver-grip torque wrench. The wrench limits torque to a predetermined amount. This is accomplished by means of a drive tang that automatically releases as the torque (measured in pounds) is reached. This type of torque wrench is often called a "click" wrench because of the sound it makes when it releases. The wrench resets itself for the next application. Torque is controlled within plus or minus 4 percent on readings at or above 20 percent of the maximum scale capacity. For more information contact: JS Technology Inc., 1000 McFarland 400 Blvd., Alpharetta, GA 30201; (404) 475-8011, fax (404) 475-4257.

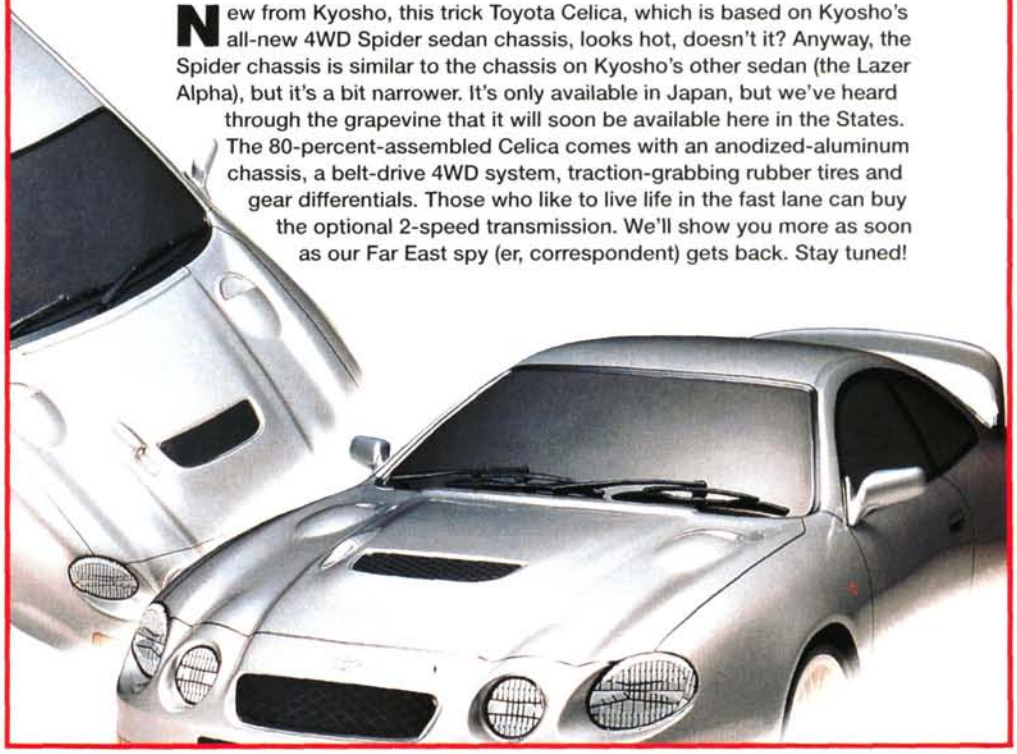
Flat-out with Flat 80s



Pro-Line's new Flat 80 rear tire combines Pro-Line's Original Mini-Pin tread pattern with its progressive flat-carcass design. This low-profile carcass was designed exclusively for the larger 2.15- to 2.2-inch rear buggy wheels and is currently used on proven, top-performing Pro-Line tires like the Flat Fuzzies (no. 8083) and Flat Stubbies (no. 8086). The Flat 80's reinforced interior walls and sidewalls provide stability while decreasing overall weight. Combine this with Pro-Line's Original Mini-Pin tread, and you've got a tire that will handle the toughest hard-packed conditions. Mark Pavidis used this tire to qualify for the A-Main on the hard-packed surface at the '94 ROAR Nationals in Tampa, FL. Contact: Pro-Line, P.O. Box 456, Beaumont, CA 92223; (909) 849-9781, fax (909) 849-2968.

We Spied a Celica!

New from Kyosho, this trick Toyota Celica, which is based on Kyosho's all-new 4WD Spider sedan chassis, looks hot, doesn't it? Anyway, the Spider chassis is similar to the chassis on Kyosho's other sedan (the Lazer Alpha), but it's a bit narrower. It's only available in Japan, but we've heard through the grapevine that it will soon be available here in the States. The 80-percent-assembled Celica comes with an anodized-aluminum chassis, a belt-drive 4WD system, traction-grabbing rubber tires and gear differentials. Those who like to live life in the fast lane can buy the optional 2-speed transmission. We'll show you more as soon as our Far East spy (er, correspondent) gets back. Stay tuned!



Kyosho
Lazer Alpha 4WD
This 1/10-scale, 4WD buggy is Kyosho's new low-cost version of the Lazer ZX-R racer. It includes a front/rear belt drive and a long-travel suspension that's patterned after the Lazer ZX-R's, but it uses a rigid, light Kelron™ chassis to keep the cost down. For greater speed and handling, the Lazer Alpha can be hopped up with ZX-R parts and upgrades.
Part no.—KYOC0104; price—$169.99.
Kyosho/Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-3630.

Paragon Racing
Eclipse Series Motor
The box-stock racer can now take the track by storm with the explosive speed provided by the Paragon Eclipse Motor—and it's Tamiya race-series legal! Each Eclipse motor is broken in at the factory and tested to exacting performance specifications; and it's available in four power-packed versions: 14-, 15-, 17- and 23-turn. The Eclipse is sure to turn some heads.
Price—$28.
Paragon Racing Products, Dept. CA2, 340 Industrial Blvd., Waconia, MN 55387; (612) 442-6364; fax (612) 442-6368.

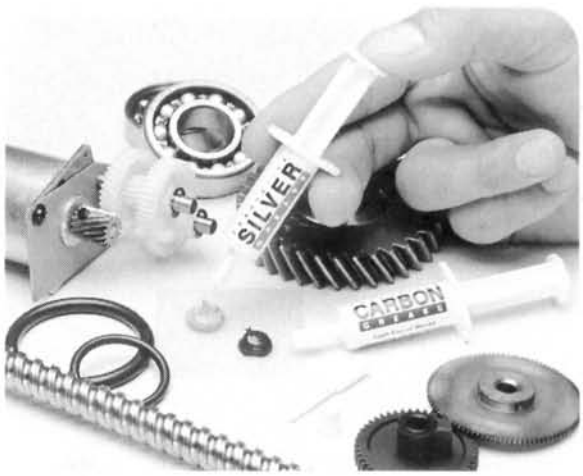
Team Losi
Replacement Caster Blocks
Don't go looking for Team Losi's machined 25-degree-caster blocks (part no. A-9705), because they've been replaced by new, 25-degree, molded blocks and spindles. If you've ordered the originals and they're back ordered, please order the new ones. Team Losi apologizes for any inconvenience, but says you're bound to like these replacements. They're cheaper, too!
Part no.—A-1121; price—$9.
Team Losi Inc., 13848 Magnolia, Chino, CA 91710; (909) 465-9728; fax (909) 590-1496.

Associated Electrics
Thrust-Bearing Washer for Stealth Transmission
Associated has given the Stealth Transmission clutch more punch by substituting this washer-type thrust bearing for the retainer-type. The kit includes the thrust-bearing washer, thrust washers, instructions and a 5-40 locknut for the Torque Clutch assembly.
Part no.—6594; price—$2.
Associated Electrics Inc., 3585 Cadillac Ave., Costa Mesa, CA 92626; (714) 850-9342; fax (714) 850-1744.

Racer's Choice
Masterlex Enamel Acrylic Spray

This acrylic spray has been specially formulated for painting polycarbonate, polystyrene, wood and metal, and it's available in a wide range of colors, including fluorescent. It's easy to apply, dries rapidly and resists cracking and scratching.
Price—$5.75 (200ml can).
Racer's Choice, 6N258 Acacia Ln., P.O. Box 405, Medinah, IL 60157; (708) 980-4863.

Planned Products
Circuit Works Conductive Greases
Developed for applications that require electrical conductivity, lubrication and protection, these greases are available in silver and carbon formulations; they protect assemblies from wear and environmental hazards while they provide excellent electrical and thermal conductivity. Based on advanced silicone lubricants, the new greases are chemically inert, thermally stable and nonflammable. To receive your free brochure, or to place an order, contact John Seaborn.
Planned Products, 303 Potrero St., Ste. 53, Santa Cruz, CA 95060-2760; (408) 459-8088; fax (408) 459-0426.



Wiha

MicroFinish Slotted Screwdrivers

Wiha's new MicroFinish Slotted screwdrivers have positive-grip, non-slip-surface handles that allow maximum force to be applied and are comfortable to hold, even with dry, oily, or wet hands (more torque means less user fatigue). They are available in two styles (Mechanics and Heavy-Duty), and with varied tip sizes and blade lengths. MicroFinish Phillips screwdrivers are also available from Wiha.

Part nos. and prices—Series 520 (Mechanics), $5.50 to $12.15; Series 533 (Heavy-Duty), $8.60 to $16.10; Series 521 (Phillips Mechanics), $6.10 to $11.40; Series 534 (Phillips Heavy-Duty), $8.80 to $14.20.

Wiha Corp., P.O. Box 960, Monticello, MN 55362; (800) 328-8310; fax (612) 295-5847.

Tamiya

Spray-Work HG Airbrush

Tamiya's chromed-brass and stainless-steel Spray-Work HG Airbrush has all the features expert modelers want most—adjustable trigger stop, a 0.3mm nozzle, interchangeable color cups and a drop-feed design—for incomparable performance. Designed to turn models into masterpieces, the Spray-Work HG will deliver years of excellent results and troublefree service.

Part no.—74503.

Tamiya America Inc., 2 Orion, Aliso Viejo, CA 92656-4200; (800) TAMIYA-A.

Dahm's Racing Bodies

Tiger X™

Dahm's exciting new Tiger X™ dune-buggy body for the Losi Double-X, made of 0.030 Lexan, is designed to increase top speed, improve handling and direct cool air onto the motor. The Tiger X™ combines the most advanced features—super aerodynamics, a low, narrow profile, a tight frame fit and much more—to give you the winning edge at the track.

Price–$16.98.

Dahm's Racing Bodies, P.O. Box 360, Cotati, CA 94931; (707) 792-1316; fax (707) 792-0137.

Parma/PSE

Dodge Ram Body

Gaining popularity all over the U.S., this new 1/10-scale oval-racing truck body is made of 0.040 clear Lexan and is the ultimate choice for 1/10-scale oval racing.

Part no.—99041; price—$19.95.

Parma Intl./PSE, 13927 Progress Pkwy., North Royalton, OH 44133; (216) 237-8650; fax (216) 237-6333.

A & L

Rear Shock Tower

The new Rear Shock Tower for the RC10GT is made of 0.125-inch-thick matte-black G-10 fiberglass that's super-stiff and looks great.

Part no.—2016; price—$9.95.

A&L Mfg., P.O. Box 2115, Corona, CA 91718; (909) 735-5249.

MIP

Onboard Temperature Gauge

Knowing the temperature of your gas engine is the key to maximizing your engine's performance. Now, with MIP's new Onboard Temperature Gauge, you'll be able to check its temperature with ease. This battery-powered gauge has an LCD readout that's visible from 10 feet away, and it displays temperature readings that range from 0 to 450 degrees Fahrenheit (a Centigrade unit is also available).

Prices—$47.50 (Fahrenheit), $49.50 (Centigrade).

MIP, 746 E. Edna Pl., Covina, CA 91723; (818) 339-9007.

TROUBLE SHOOTING

by John Huber

Abracadabra!

I recently bought a Turbo Inferno 4WD car. Can you tell me what parts I would need to make it into an Inferno ST, and where can I find these parts?
FRED ABRAMOWSKI,
Bath, NY

Fred, if you convert your Inferno buggy into a truck, you'll end up with a truck that's better than the ST. You'll need a few parts to make the conversion: 2 sets of rims (no. BS-133), 2 sets of tires (no. BS-132), front and rear shock towers (no. GT-6), body posts/bumper (no. BS-134) and a body and wing (no. BS-135). Kyosho also recommends that you add a set of DuraTrax foam inserts for 1/10-scale trucks (no. DTXC-8305) to prevent the tires from "ballooning" under acceleration.

Make sure that you sand all the chrome plating off the part of the rim where the tire will be glued. If you don't, the tire will fly right off. Another good idea is to put some very thick diff grease on the center diff to prevent it from unloading. Because you're running larger tires, you might want to play with the gearing, too. If you leave the stock gears in the truck, you'll have crazy top speed and less low-end punch. You can adjust the ratio by adding the DuraTrax center gear (no. DTXC-3061, 51 tooth) and try different clutch bells. When you've finished, you'll have one sick truck!

Idle Conversation

I recently purchased an RC10GT with an O.S. CZ-R engine, and I have a couple of questions about tuning. I'm having an extremely hard time getting the engine to idle correctly. Mid-range and top end are great, but when I need the car to sit still for a second or two, it usually dies. The tuning instructions that came with the engine don't mention the low-end needle. Also, how critical is the length of the tuned pipe in regard to performance?
DJM, Spring, TX

The first thing you should check is the idle screw. Adjust it so the engine revs but doesn't cause the car to move. If that's OK, try leaning the low end by turning the screw in a click or two. Pinch the fuel line near the carb, and see whether the engine revs or fails. If it revs up, it's rich; if it dies, it's lean. Tuned-pipe length is important, but many people will argue whether the GT's pipe is tuned at all. Try altering the pipe length and note the changes you see. If you need more info, check out the "Pipe Basics" article in the April 1994 issue.

HELP, I'M MELTING...

I have a Team Associated RC10GT. The truck is great, but I have a problem with it. The idler gear in the Stealth transmission has melted twice. The transmission has bushings in it. Would adding ball bearings help, or do I just have to keep buying new idler gears all the time? Also, would MIP CVDs work in the RC10GT? Will the Traxxas Nitro Hawk body fit in this truck?
SEAN CORDOVA,
Pueblo, CO

Sean, I've never heard of a problem like this, but it must have something to do with the bushings. Bushings create more drag than bearings, and they'll create more heat. If drag becomes excessive, it will melt the gear. Make sure that the bushings are well-lubed and that they allow the gear to spin freely. The best suggestion that I can make? Get a set of ball bearings; that should fix the problem! And yes, you can use MIP CVDs, and, with a little careful fitting, the Traxxas body will fit.

ILLUSTRATIONS BY JIM NEWMAN

by John Huber

Setting up your servos right

ARE YOUR SERVOS geared properly? What?...Servos?... Geared? Believe it or not, the way that you set up a servo has a lot to do with the speed and power it will produce and how much control you'll have.

Let's say you have a servo with a solid horn on it. The horn has three holes (see Figure 2) that connect it to something—let's say a steering system. Which hole should you use? If you use the one farthest from the center mounting screw, you'll get the maximum movement from the link. If you mount it in the hole closest to the center, you'll get less movement. The steering system usually has a selection of holes to choose from as well. How you make this connection will affect your servo's speed, power and resolution.

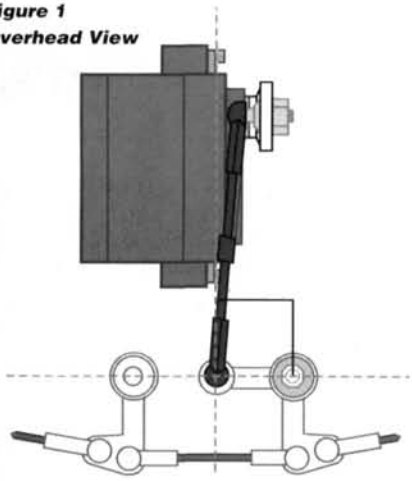


Figure 1
Overhead View

Try to keep the steering link parallel to the center line of the chassis. You can do this either by moving the servo or by adjusting the link's connections to the servo horn and the bellcrank.

It's common to see a car with its link connected to the farthest hole and then trimmed down with the transmitter; this is bad, because: first, you lose a lot of resolution because you limit the range of the servo; second, in exchange for a little speed, you lose torque that the servo can provide. You'd be much better off connecting the link farther in and adding as much trim as possible. To see whether your servos are connected correctly, just look at your transmitter. If your transmitter has end-point adjustments (EPA or ATV), try to keep them above eight. The same goes for a dual-rate dial; keep it at 80 percent or above.

Don't forget that you can also change the travel at the bellcrank connection. If you connect it closer to the pivot point, you'll get more travel, and vice versa. This is also true for servo-to-carb connections. On the CZ-R carb, there are two connection holes on the throttle arm. If you use the one closer to the center, you'll get more throw. (There! It does have something to do with nitro!)

GET THE ANGLES RIGHT, TOO

Getting all the angles in your connections right is very important. Basically, all the linkages between the servo and the bellcrank should be at approximate right angles. This goes for all directions! On a car such as the RC10, the servo horn is vertical and rotates front to back. It's connected to a bellcrank that rotates horizontally side to side. The simplest setup (see Figure 1) is to connect the link with the bellcrank straight ahead and to the servo horn perfectly vertical.

Though that setup works well, we're forgetting about two other angles. On the RC10, the link between the servo and the bellcrank, when viewed from the side, usually has a steep angle (see Figure 2). This gives the connection between the link and the horn an angle of less than 90 degrees, which will cause more throw in one direction. You can correct it by shortening the rod a little and re-centering the linkage.

The other angle to consider is the angle of the link and the center line of the chassis (see Figure 1). This angle will depend on how large your servo is and through which hole you mounted the link on the bellcrank. Try to keep the link as straight as possible, running front to back.

WHAT'S NEW IN NITRO?

If you want to get a better idea of how hot your engine is without spending a couple of hundred bucks, check out MIP's* new onboard temperature gauge. The little sucker weighs just ½ ounce and is only 1¾ inches long. Stick it on your chassis, bolt the sensor that's on the end of the wire to the heat-sink head, and you're in business! The gauge will display temperatures of up to 450 degrees (way too hot!). The MIP temperature gauge is good for the times that you want more than temp tape and less than a temp gun. Look for a full review in a future issue.

**Addresses are listed alphabetically in the Index of Manufacturers on page 169.* ■

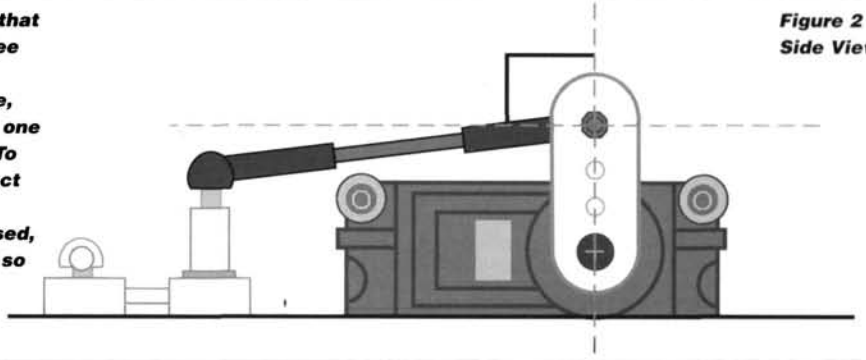


Figure 2
Side View

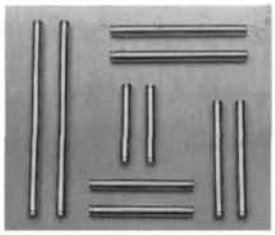
In this view, you can see that the link isn't at a 90-degree angle to the servo horn. Without a 90-degree angle, the car will steer more in one direction than the other. To correct this, either connect the link through the hole below the one that you used, or adjust the rod's length so that there is a 90-degree angle between the rod and servo arm.

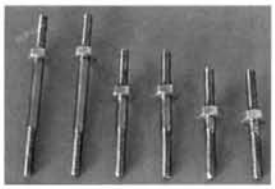
by Brian Leslie

10 Crucial Questions

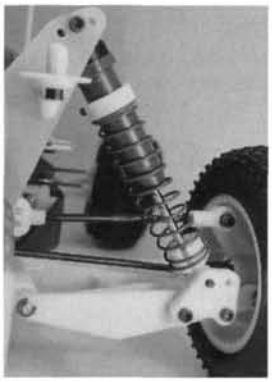
RECENTLY, a friend of mine from work bought an off-road, gas truck. He's as new to the sport of R/C as you can get, so once again I'm answering questions that I haven't thought about in years. But this is good. Helping others to get started in our fine hobby is really what it's all about. Just a little guidance here and there can really relieve a lot of frustration for a beginner. I figure that no one should have to go through what I did when I began R/C. So here are answers to a few of the more common, everyday R/C questions that I've heard tossed around.

1. Why do people use titanium tie rods and titanium hinge pins?
Titanium is much stronger—but weighs one-third less—than steel. Steel tie rods in off-road cars and trucks have a tendency to bend and break quite easily. Titanium replacement parts remedy this problem.



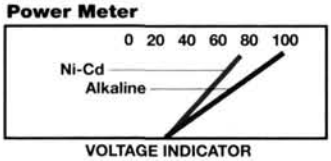


2. Why is it that when I move my rear shock collars down to gain ground clearance, the car spins out more easily?



When you lower a shock collar you place more of the car's weight on that particular shock. The shock and wheel with the most weight on them will always be the first to spin or slide out. If you raise the rear shock collars and lower the front shock collars you'll find that the car won't spin out as easily, but it won't want to turn either; this is because more weight is now on the front tires.

3. Should I use Ni-Cd batteries or alkaline batteries in my radio transmitter?
Ni-Cd batteries are good because they're rechargeable; but they also produce only 1.2 volts per battery. This means that you'll never see a full, 100-percent power reading on your transmitter meter. This is OK, though, because the power Ni-Cds can deliver—about 80 percent—is more than



enough to operate the transmitter. Alkalines, on the other hand, will produce the 100-percent power reading and will last longer at that reading. But when they're dead, they're dead; alkalines can't be recharged.

4. Should I buy an AM transmitter or an FM transmitter? What's the difference?
AM radios are good, especially for sport enthusiasts. They also work well

around the yard. Racers, however, should consider an FM transmitter because they're less susceptible to interference from other transmitters or other frequency sources. FM transmitters also have a greater range—although a greater price—than AM.

5. Why do off-road cars have their wheels tilted inward so much?
When you tilt the tops of the wheels toward the

chassis, you have negative camber. (This adjustment is made by the upper control link.) The more the wheels are tilted inward, the harder it is to spin the car out. This makes the car more stable, but it also makes it harder to turn. Because the wheels are tilted inward and the tops of the tires are pushing inward against one another, a lot of speed is scrubbed. So it's a trade-off between speed and stability.

Helping others to get started in our fine hobby is really what it's all about.

6. How long will a .12 nitro-powered engine last?
If you take exceptionally good care of a nitro-powered engine, you should get one to two gallons of fuel through it before it's time to change the piston and the sleeve.

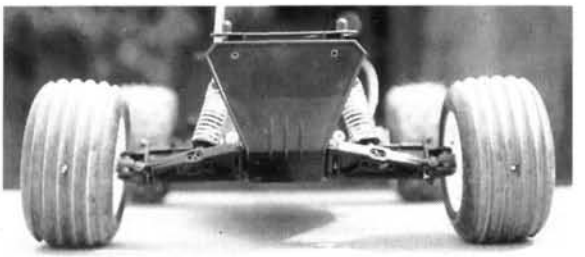
7. Should I buy servos with metal gears?
Unless you run a ¼-scale car or a ⅛-scale off-road buggy, stick to servos with nylon gears because they're smoother and they'll last longer. Metal gears wear more quickly and they usually have more backlash; they tend to be more expensive, too.

8. Do gas cars require different transmitters than electric cars?

No. Just like electric cars, gas cars use a servo for steering, but they also use a servo for the throttle and the brake. Most transmitters have a low and high ATV endpoint adjustment to help you achieve the proper carburetor and brake setup. You can run a gas car with a transmitter that doesn't have these adjustments, but it's more difficult to set the linkages.

9. Why do I need to poke holes in my tires? Why not the rims?

If you've ever squeezed a shampoo bottle and then quickly covered the opening, you've probably noticed that the sides of the bottle remain sucked in. When you uncover the opening, the bottle pops back out to its original shape. The same thing happens to off-road tires; when the tire is compressed, it blows all the air out and flat spots appear in it. When you poke holes in the tires you prevent them from "flat spotting."

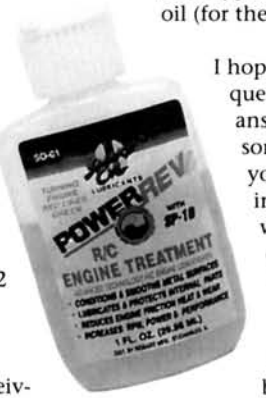


By poking holes in the tires instead of the rims, you give the dirt that has found its way inside the tire a way out.

Centrifugal force will spin the dirt out through the holes in the tire; if the holes were in the rims, you'd have to remove the tires to get the dirt out.

10. What items do I need to run a gas car?

You need: a transmitter and receiver; two servos (with at least 60 ounces of torque each); 12 AA batteries (eight for the transmitter and four for the receiver); fuel (10- to 20-percent-nitro content); a glow-plug igniter; a starter box or a hand-held starter motor (if the car isn't equipped with a pull-starter); a fuel bottle or a turkey baster (to get fuel into the car); and Marvel™ Mystery Oil, or some type of after-run oil (for the engine).



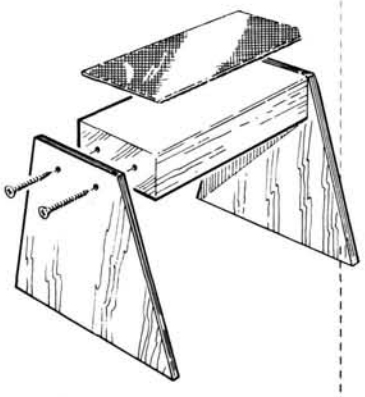
I hope that these questions and answers will somehow make your entrance into the R/C world a little easier. Next month I'll ponder—and answer—some more beginners' questions. ■

PIT TIPS

by Jim Newman

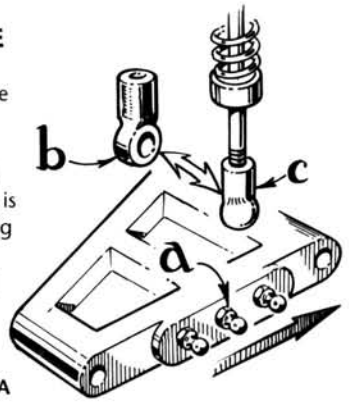
CHEAP CAR STAND

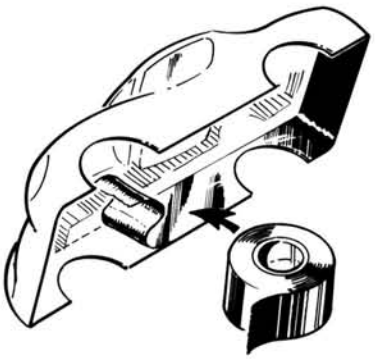
Glue and screw plywood or Masonite® end pieces to a short, 2x4-inch (50x200mm) piece of wood, then glue the rubber from an old bath mat to the top to prevent the car from slipping off.
Garrett Toknno, Honolulu, HI



RC10T QUICK-TUNE SUSPENSION

Screw ball joints (a) into the "A" bracket, then remove the standard rod end (b,) and replace it with the ball cup (c). Suspension tuning is rapidly changed by popping off the ball cup, and the ride is softened by moving the bottom of the shock in the direction of the shaded arrow.
Michael Carben, Butler, PA



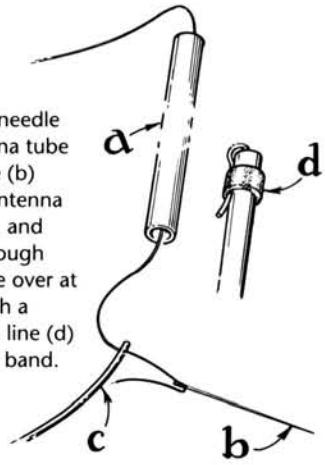


ANTI-SPLIT TAPE

To make your car's body more resistant to cracking and splitting, apply wide, brown, packing tape around the lower inside of its shell.
Kevin Suydam Jr., Edmonds, WA

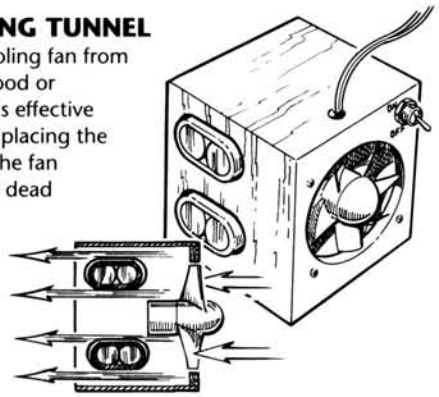
E Z ANTENNA THREADING

Drop a threaded sewing needle down through the antenna tube (a), then push the needle (b) through the end of the antenna wire (c). Knot the thread, and pull the wire back up through the tube. Double the wire over at the top, and secure it with a short piece of rubber fuel line (d) or an orthodontic rubber band.
Terry Norman, Colorado Springs, CO



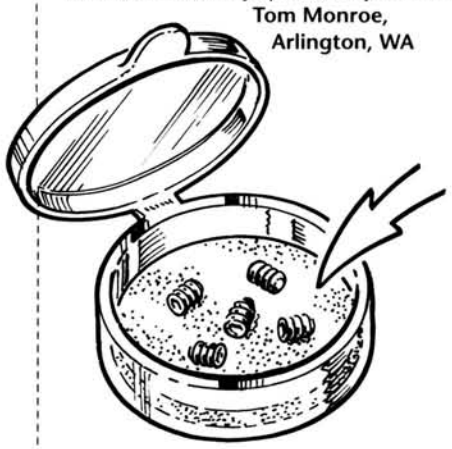
BATTERY COOLING TUNNEL

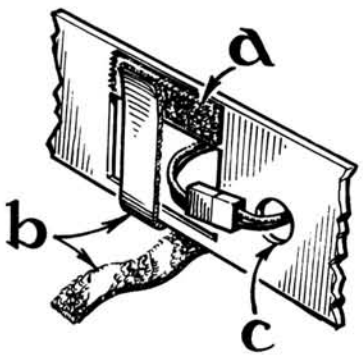
Use an inexpensive cooling fan from Radio Shack and plywood or Masonite® to create this effective cooling tunnel. (Avoid placing the packs directly behind the fan motor where there is a dead spot in the airflow). Hook up two leads and clips to a suitable battery.
Derek Thorson, Bourbonnais, IL



NON-SPILL SCREW CONTAINER

Use a small, plastic, snap-lid container such as the one that holds Associated grease. Clean it thoroughly and line the bottom with servo tape. Press small items, such as setscrews, onto the exposed adhesive. When the lid is opened you will not accidentally spill the tiny screws.
Tom Monroe, Arlington, WA





OUTLAW ULTIMA BATTERY STRAPS

In your dirt guard, cut out an access hole for the battery pack, then glue the "hook" part of a piece of Velcro®-brand fastener as shown (a), and glue the "furry" halves of the fasteners also as shown (b). To make it more convenient to connect the power plug to the socket, drill a 5/16-inch-diameter (8mm) hole (c).
Tim Dybvig, Princeton, NJ

R/C DOCTOR

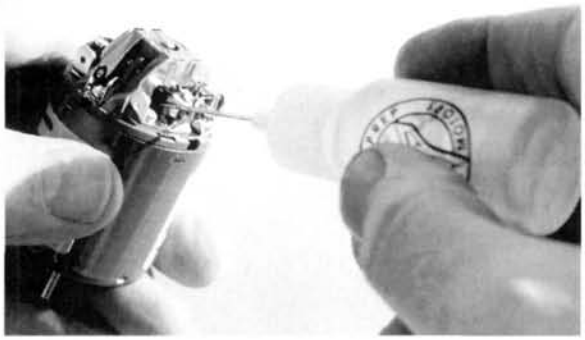
by Doug Mertes

Comm Drops
PART DEUX

Three new comm drop products have come on the market since my last evaluation: The Stuph, Race Prep's Powerzone Drops and Extreme's Johnny Juice.

IN THE JULY '94 issue, I tested eight comm-drop electric-motor brush additives. Four of those products (CRC* Speed Juice, Class* Liquid Horsepower, Aero-Car* Conducta Motor Drops and Trinity* Comm Drops) produced modest gains in rpm and reductions in amp draw. Three new products have since come on the market, and each has an advantage over the winners of the last test.

Chris Harker, an alert Car Action reader, sent me a .5-ounce bottle of The Stuph*—a thin red fluid that's supposed to work like WD-40, although it's not an aerosol. It displaces moisture, lubricates, loosens seized parts and does a bunch of other things I couldn't care less about, because I just wanted to see if it made my motors go faster.



Most comm drops are applied by simply squirting a drop or two onto the brush end or directly onto the commutator. Spin the rotor to spread the drops, and you're ready to go!

Mike and Steve Dunn at Race Prep* sent me some of their new Powerzone Comm Drops. This product is clear, a little thicker than other comm drops, and it comes with a dyno readout that backs up Race Prep's claim that this concoction increases power and reduces brush glaze during 4- to 8-minute races.

Erik Soderquist sent along some of his Johnny Juice*, also reputed to eliminate fade during longer races. I knew for a fact that it had been used on a handful of national title winners, and I was anxious to get my hands on it.

TEST-OLA

As before, the test bench included a computer-controlled dynamometer. I ran tests on a half dozen ROAR- and NORRCA-legal stock and modified motors with both vertical and laydown brush configurations. I like the dyno because it lets me store all of the individual dyno runs on my computer's hard drive. I can call up the data later and compare results using charts and graphs included with the software. This equipment was designed by a NASA engineer, and it shows!

Each motor was run three times on the dyno to break in the brushes and establish a base-line reading for power, torque and amp draw under load. The motors were then treated according to the directions that accompanied each product. Because The Stuph came without any instructions, the drops were simply squirted onto the commutator, and the rotor was turned to spread the drops around the comm. After treatment, each motor was then rerun on the dyno to determine how the comm drops affected its performance.

I ran each test with several types of brushes: hard, soft, silver and venturi. There was a noticeable performance improvement over stock OEM levels with all of these brushes, but the drops improved performance in all of them to the same extent. In other words, you'll get the same kind of performance enhancement from the comm drops regardless of which type of brush you use.

In the next group of tests, I tried changing motor brush springs. Lighter springs showed the effect of the power drops for a longer period of the dyno run than a motor that was equipped with heavier springs. Heavy springs probably cause the drops to be scraped or burned off more quickly. Both tension extremes, however, showed positive results from using the drops.

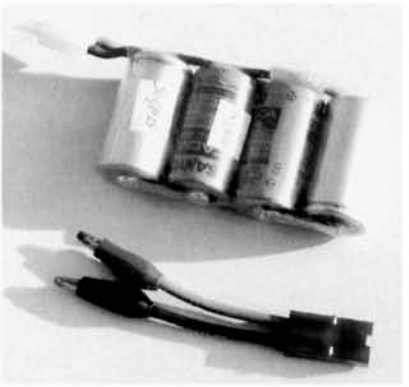
You may remember that the previous test winners provided, on average, an additional 400rpm on the top end of the power curve and a reduction in amp draw of about 10 percent, regardless of motor, brush, or spring type. Each treated motor also reduced brush glaze; the untreated motors did not. At the time, I was unsure whether glazed brushes had any negative effect on motor performance. I retested each motor—with and without glazed brushes—and saw no real performance change that I could attribute to that condition alone. I know now that I needed to devise some more sophisticated tests in order to measure the performance change caused by brush glaze.

This time, I set up a series of sequential dyno tests that simulated 4- and 8-minute races and included cycling the motor up and down through its power curve using different load levels. As a final step, I ran a standard dyno test to measure amp draw, power and top rpm.

What did I find out? Brush glaze does, indeed, seem to increase amp draw and reduce top end—both of which are very nasty things that will keep you from winning races. The interesting thing is that it only seems to affect a hot

motor, not a cold one. If you let the motor cool down to room temperature, the motor seems to run the same with or without the glaze present. Use drops that reduce the glaze, and you won't have to clean the comm so often. Motor efficiency decreases, especially in longer heats or high load conditions where motor temperature gets really high.

This also explains why many top racers say that they never, never, never pull the brushes from their stock motors at a regional or national race once the heats have started. It sounds bizarre, I know, but I'd heard that advice so many times that I decided to try to find out why. I'd always thought that you were supposed to pull and clean the brushes and comm after every heat if you wanted top performance. It seems that removing the brushes changes the surface interface between the brush and the commutator. Leaving the brushes in the hoods for a couple of heats ensures that the motor's performance will be maintained at the same level heat after heat. That's why brush-glaze reduction is so important to these guys. Of course, when their motor slows down, they pull it and toss it. We normal folks, who want a motor to last a long time, can probably do without that small percentage of extra power, and should clean the brushes and commutator every three or four runs.



You can use old cells to make a 4-cell pack like this one. It's handy for spinning the motor and spreading the drops around before installing it in your car. Extreme Motorsports recommends this method. Try it!

WHICH ONE WORKS?

The Stuph (which I've recently seen in a number of hobby shops and catalogue advertisements) works about as well as the best of the first test group, and this resulted in a minor top speed increase and a reduction in amp draw. As a side note, I rubbed some on the dogbones and turnbuckles of my off-road car. These were two areas that I'd previously been unable to keep rust-free, but The Stuph has done a great job for the past five months. I'd keep a bottle of it around for that purpose alone!

Extreme Motorsports' Johnny Juice worked better. The application instructions tell you to put several drops behind the negative brush and run the motor at low voltage until the speed increases. Then put four more drops behind the highest brush so that gravity encourages the drops to move onto the commutator just before the race. Spin the wheels or spur gear to move the comm and even the surface layer before the race starts. I found an average 650rpm increase in top end using this product, although ramp-up time was increased somewhat. This is probably a great product to use for on-road and dirt-oval applications, but be aware that Extreme recommends that you thoroughly flush out the motor and comm after each use.

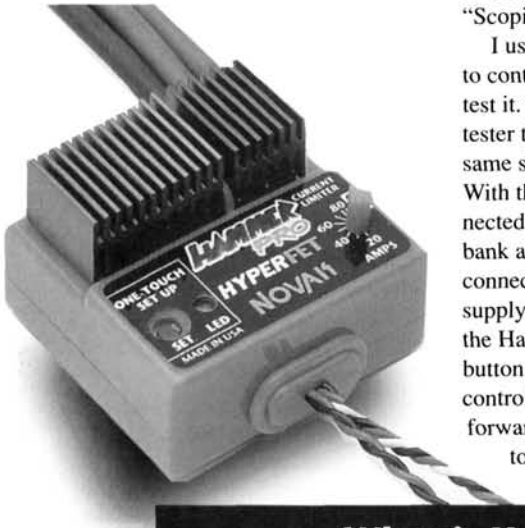
Race Prep's Powerzone Comm Drops was the clear winner this time around. Only one drop per brush per run is needed, so a ½ ounce bottle will last for a couple of months, even for an active racer. Drop it in, spin the motor, and pick up an average of 800rpm on the top end and a reduction in amp draw of almost 20 percent as measured by the dyno. Brush glaze is virtually eliminated, and you don't have to clean your motor after every race. Power at the end of the long, 8-minute dyno test was within 2 percent of the first, short run. These numbers are easily twice as impressive as the best of the first group tested 10 months ago. These are the comm drops I'd use for 8-minute, 12-scale, carpet-oval, or Formula 1 races.

If you'd asked me a year ago if commutator drops were a worthwhile addition to a racer's toolbox, I'd have said no way! Improvements in existing products and the introduction of new comm-drop fluids have changed my mind, and now I take a bottle to every race I attend. When the Mains come up, you'll see me squirtin' away!

**Addresses are listed alphabetically in the Index of Manufacturers on page 169.* ■

by John Rist

Novak Hammer Pro



What it Has

- Five FETs wired in parallel for handling forward current.
- A massive collection of FETs to handle braking.
- One-Touch Setup™ system—a marvelous feature that allows you to match a Novak ESC to your transmitter in less time than it takes to eat a 10-cent candy bar.
- Dial-a-current punch control.
- A world-class *low* "on" resistance of 0.0014 ohm—probably the single most important feature of a racing ESC.
- High-frequency motor control.
- Easy-to-set current control.
- Automatic thermal shut-down.
- Reverse battery protection.
- Radio Priority Circuitry.

And a hot decal set, heat sinks, three motor capacitors, Shottky diode, 9 inches of 12AWG monster wire (red), mounting tape and receiver plugs for all the popular brands of radio.

NOVAK'S* top-of-the line electronic speed controls (ESCs) are used by a lot of pros, and they consistently show up in the winners' circle at every level of R/C car racing. Their newest—the Hammer Pro—is definitely for those who want the very best in a racing-style ESC.

HAMMERING THE HAMMER

Let's subject the Hammer to the rigors of my "Scoping Out" lab:

I use my Pit Stop radio to control an ESC while I test it. The radio is a servo tester that puts out the same signal as a receiver. With the motor wires connected to my resistor load bank and the battery wires connected to my bench supply, I simply pushed the Hammer's program button and rotated the control on the radio from forward to brake and back to neutral. I checked the setup's accuracy with my oscilloscope; it had been set correctly. I like my throttle to arrive at full "on" at about the 80-percent point of trigger travel, and this is precisely the setting the One-Touch™ setup gave me.

• **Test 1. Resistance.** With 12 amps of current flowing, I measure the voltage drop across the ESC and then calculate its "on" resistance by dividing the measured voltage drop by 12. I measure resistance twice—along the full length of the motor wires and battery wires (including connectors) and 2 inches along them. The first reading helps me to determine an ESC's "on" resistance as it comes from the factory, and the second gives a standard reading with which I compare ESCs.

Voltage drop along full length of wires: 0.05 volt—a resistance of 0.004 ohm.

Voltage drop 2 inches along the wires: 0.03 volt—an amazingly low resistance of 0.0025 ohm (definitely a tie with the leader—Novak's 410 HPc). I'm impressed!

• **Test 2. Cooking time!** I "cook" every controller I test by adjusting the resistor bank to pass 20 amps of current, jamming the throttle wide open and running the ESC for 15 minutes while it pumps a hefty 20 amps—without any cooling air (no fans allowed).

After 10 minutes, the heat sink was barely above room temperature. After 25 minutes (I had to answer the phone), the heat sinks were only slightly warm. With a resistance reading of only 0.0025 ohm, you just won't get much heating. The power being dissipated by the Hammer Pro when it's handling 20 amps is a measly 1 watt, which it could handle indefinitely without working up a sweat.

• **Test 3. A dead short.** In my dead-short test, I check to see whether the ESC could survive the heavy current it would have to withstand if a gear jammed or the motor fried. The current jumped to a hefty 40 amps, and the FETs started to heat up, but they were never hot enough even to activate the automatic thermal shut-down.

ITS MANUFACTURER CLAIMS...

...that the Hammer Pro has reverse-voltage protection without the use of a fuse. It goes against my grain to reverse the battery leads on an ESC, because in years gone by, most of them would have gone up in a cloud of smoke if you did that. With teeth gritted, I plugged the battery in backwards. My current meter did register a little reverse current, but there was no smoke, and after correcting the battery connections, I found that the Hammer Pro was operating normally again.

Novak also claims that the Hammer Pro's "digital glitch-prevention" will reduce radio problems. This is hard to test, but I never experienced any glitching.

HAMMER ON THE HIGHWAY!

I gave the instruction sheet a second thorough reading to make sure that I understood how to install and set up the Hammer Pro. It requires that a Schottky diode and three 0.01-microfarad capacitors be soldered across the motor. In high-frequency ESCs, it's now common practice to install a Schottky diode

across the motor leads to suppress the reverse-voltage "noise" spikes that can destroy the FETs. In the Hammer Pro, the Schottky diode is directly across the motor. This makes setting up a new motor slightly more difficult because you must install the diode as well as the three 0.01-microfarad capacitors; but this is a small price to pay to eliminate noise glitches and prevent your expensive ESC from being destroyed. Be careful to install the diode with its striped end to the positive (red) motor lead. If you put the diode in backward, it will explode the first time you advance the throttle.

The good news is that if you use a budget radio system that doesn't have any of the functions called out in the instruction sheet, you'll still be able to match your transmitter to the Hammer Pro with just one push of a button. The reversing switch can be in the normal or reverse position, so even budget stick radios that don't have a channel-reversing switch can be used to pilot the Hammer Pro.

The instructions show everything being hard-wired, i.e., no connectors. I prefer to hard-wire my motor, but I do use Litespeed* battery connectors because, for my R/C product tests, I swap batteries, and connectors save me time. The Litespeed connectors are inexpensive and have virtually no power loss, but if you run in major races, hard-wiring is still the most efficient setup.

I installed the Hammer Pro in my RC10 Team Car and matched it to my Futaba Magnum AM radio—a procedure that took about 5 seconds and one push of the button. The car has a Trinity 13-turn double-wind motor, can run a 6- or 7-cell 1500mAh SCR battery and is geared for a 5- to 6-minute dump. I installed an old pair of pin-spike tires that I could afford to risk destroying on pavement.

Following Novak's advice, with the current-limiting knob set to maximum current ("Off"), I hammered the throttle. The car exploded along the pavement with its back wheels spinning violently. I backed off the throttle a little to let the tires get some bite and then nailed it again. By this time, it was time to turn the car around and go screaming in the other direction.

The battery pack started to dump, but I kept on driving to test Novak's Radio Priority Circuitry, which is supposed to provide enough voltage for the receiver to retain control, even when the battery has dumped. The car slowed to a crawl, but I didn't lose steering or motor control. I pushed the car until the battery died and the car stalled, but there weren't any steering glitches.

The Hammer Pro is one of the best ESCs that I have ever driven—tire-smoking acceleration, blinding top speed and excellent run times. Its high-frequency motor control ensured a silky-smooth throttle response in the mid to slow ranges, the brakes were strong, yet controllable, and the heat sinks were anything *but* hot. With a low resistance, hot modified motors geared to dump in 4 to 5 minutes are no problem; just remember to install the heat sinks and mount the controller where it will get cooling air.

On the second run, I started with minimum current (20 amps on the dial). The wheelspin had disappeared and acceleration was slow, but top end was still fairly good. I then jacked up the current a little at a time until I had the car dialed in to a point at which wheelspin was minimal, acceleration was brisk and top speed was maintained.

Novak's advice on setting the current limit is right on target: to avoid wasting energy, start at maximum current and slowly reduce it to a point at which acceleration seems to suffer. This reduces the initial current surge that rushes through the motor when you nail it. (This current surge generates heat and shortens run times.)

Novak also advises that, to control traction on slippery tracks, you should start with the current set to minimum and increase the setting until the car is almost difficult to control during acceleration. This would be the point at which you have all the power that the track can take. Finally, Novak says, "For maximum punch, turn the knob to the 'off' position and *HAMMER* the throttle!"

Novak Hammer Pro

DIMENSIONS	
Height	1.9 in.
Width	1.64 in.
Length	1.73 in.
Weight (w/wires and heat sink)	2.7 oz.
TUNING	
Access to controls	Excellent
Ease of adjustment	Excellent
Price/Warranty	$97.99/90 days
ELECTRICAL (manufacturer's specs.)	
Max. voltage	10 cells
Min. voltage	4 cells
Rated current	300 amps
Resistance	0.0014 ohm
TEST PARAMETERS	
Voltage	6 volts
Current	12 amps
Voltage drop	
—along length of wires	0.05 volt
—2 inches along wires	0.03 volt
Resistance*	
—along length of wires	0.0041 ohm
—2 inches along wires	0.0025 ohm
BEC output, 6-cell Battery	5.93 volts

Resistance* = Voltage drop ÷ Current

COMMENTS: this is a world-class racing ESC. Novak uses Hyperfets, monstrous 12AWG battery and motor wires and very heavy copper circuit runs—quality! The Hammer Pro replaces the 410 HPc as Novak's top-of-the-line racing ESC.

CONCLUSION

The Hammer Pro has the lowest ESC resistance that I've ever measured, so it can handle the hottest modified motors. I'm sure that it can also handle the twin-motor setup in MRC World Scale vehicles. But don't use it for insane speed runs, drag racing, or 16- to 32-cell truck pulling; it wouldn't be able to stand the high voltage of these classes.

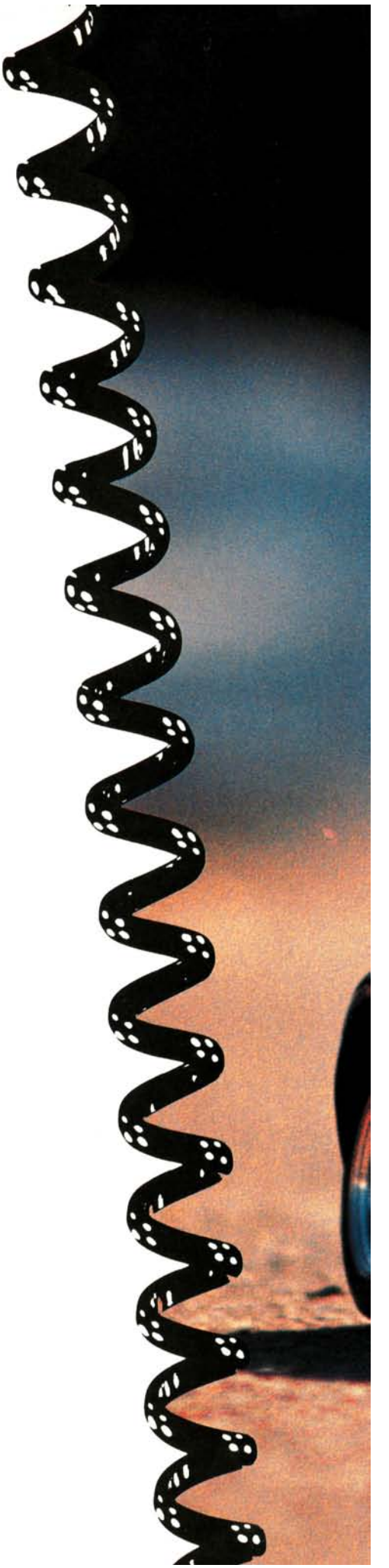
The Hammer Pro is destined to win races—lots of races. It isn't a substitute for having a well-set-up car and practicing for hours, but it's definitely what you need if you're looking for the very best in a racing-style ESC.

**Addresses are listed alphabetically in the Index of Manufacturers on page 169.* ■

CAR ACTION THRASH TEST 1/10 SCALE GAS

KYOSHO Porsche 911

by John Huber



THE PORSCHE 911 is one of the most famous sports cars ever built. It's very small and light, and it's powered by a highly sophisticated German powerplant. Porsche 911s have been raced by professionals and driven by citizens fortunate enough to afford one. Luckily for us, Kyosho's* 911 is priced so we can all afford the thrill of owning and driving a Porsche!

KIT FEATURES

The Kyosho 911 is based on the Sandmaster off-road buggy chassis. It comes 90 percent assembled, like the Sandmaster, but the 911 has a few differences—mainly the tires and wheels—that make it better suited to pavement. Because it's a Porsche, it needs a good, fat set of tires, so chrome five-spoke rims with fat slick rubber tires are included.

PHOTOS BY JOHN HUBER

The kit also features a 4W independent suspension with plastic oil-filled shocks. The design is versatile enough to go off-road, but you wouldn't want to do that with a Porsche!

The 911 is designed with beginners in mind, so ball bearings aren't included in the kit. I added some to the front wheels and rear axles, but I left the rest as it was.

The GS-11 engine comes with a pull-starter, so you don't need a starter to get it going. The carb has only a high-speed needle for adjustments, and that scared me at first. As it turned out, it worked fine, and this setup is actually easier for beginners to deal with because there's only one needle to think about.

TEST GEAR

I equipped the Porsche with a Futaba* Magnum FM and a couple of 9301 servos. The car has a small compartment for four AA batteries for the receiver, but I used slightly larger (800mAh) Ni-Cds. I had to cut some plastic to get the pack in, but oh, do I get a lot of time from the pack! For fuel, I used Blue Thunder* 20 percent nitro.

PERFORMANCE

I headed out to an empty parking lot to start the engine and break it in. The GS-11 started up very easily, and the idle was very steady. I ran the car around without the body, at a moderate speed, for four tanks of fuel, being careful not to let it get too hot or to rev too much. After four tanks, the engine started to gain power and speed as it broke in.

dial 911

SPECIFICATIONS

Scale.....1/10
List Price.....$299.99

DIMENSIONS:
Overall length.....20 in.
Wheelbase.....11 in.
Front width.....9.5 in.
Rear width.....9.5 in.

WEIGHT:
Gross (ready to run).....3 lbs., 15.4 oz.

CHASSIS:
Type.....Pan
Material.....Keiron

DRIVE TRAIN:
Type.....Gear
Primary.....Clutchbell/spur
Transmission.....Gear
Differential.....Gear
Slipper Clutch.....None
Bearings/bushings.....Plastic bushings

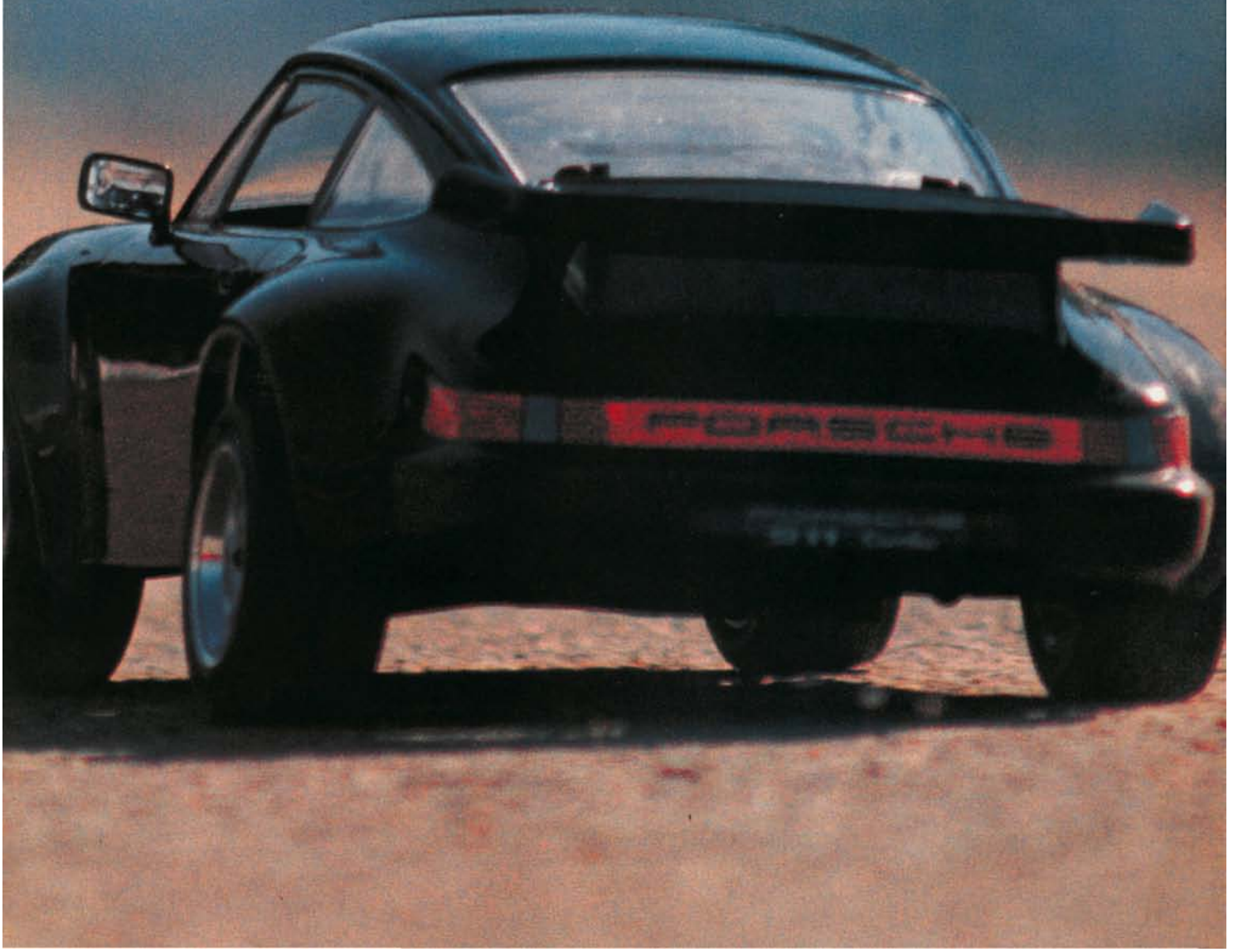
SUSPENSION:
F/R: Type.....Lower A-arm/fixed upper link
Damping.....Plastic oil-filled coil-over shocks

WHEELS:
Front-Type:.....Chromed-plastic five-spoke
Dimensions (DxW).....2.0x1.4
Rear-Type:.....Chromed-plastic five-spoke
Dimensions (DxW).....2.0x1.4

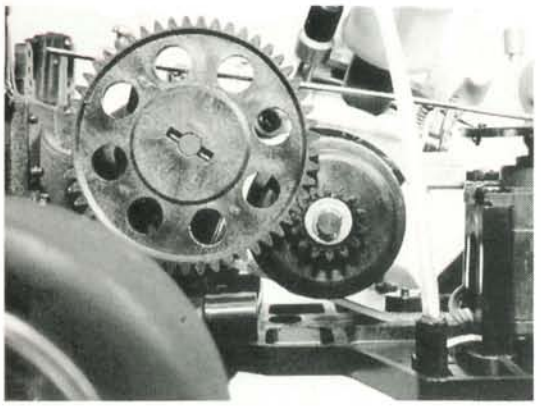
TIRES:
Front /Rear.....Semi-pneumatic slicks

POWERPLANT:
Engine, pipe, carb.....Kyosho GS-11 or OS FP-10, stock carb and muffler

OPTIONS TESTED:.....Futaba 2PD FM radio system with 9301 servos, 800mAh receiver pack, Equalizer shocks, axle bearings.



As I drove the car, I noticed that it had a lot of chassis roll. The suspension was way too soft, which caused it to lean to one side when turning, and it made the nose rise and fall when the throttle and brakes were applied. My first idea was to add heavier oil to the shocks, but I had only limited success. The rear shocks are mounted vertically, which makes them very springy, and even 80WT oil didn't seem to help. I tried several spring and oil combinations, and I eventually switched to a set of Kyosho Ultimate oil shocks. They gave me a much wider range of damping options, and I was able to get the car dialed better.



The plastic clutch bell scared me at first because I thought it would surely melt, but after many tanks of fuel, it's holding up fine. Make sure that you keep the needle bearing well-lubed to prevent it from binding.

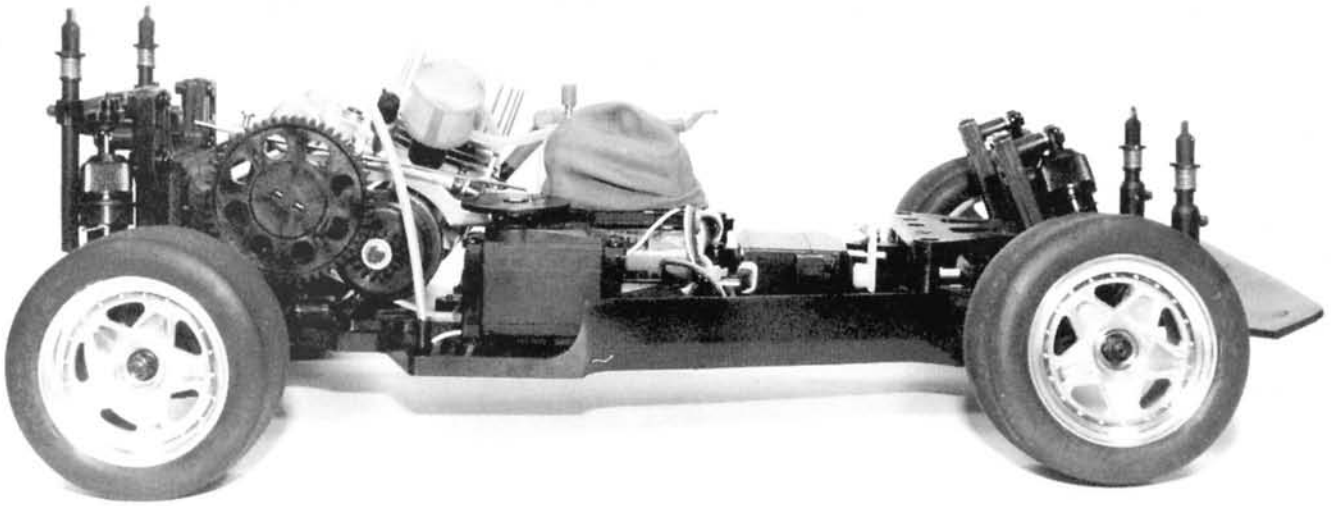
The vertical arrangement of the rear shocks made it difficult to find an oil/spring combo that performed well. I eventually replaced the plastic shocks with a set of Kyosho Equalizer shocks, and performance was much better.

Things You'll Need

Most gas cars require a whole bunch of extra parts to get them running. The Kyosho Porsche comes with a pull-start engine with a muffler, so you'll need only some fuel, a glow-plug igniter and a 2-channel radio with a receiver pack to get it running.

Factory Options

Factory options for the 911 include a complete set of ball bearings; Equalizer or Kyosho Gold shocks; and a complete line of shock oils. You can also replace the dogbone drive shafts with a set of Kyosho universals.



Kyosho's Porsche 911 is based on their Sandmaster off-road chassis. It comes 90-percent assembled with the GS-11 engine mounted on the chassis.

likes

- With all its separately molded parts, such as the wing and mirror, the body looks very realistic.
- Its price: beginners can afford to get into a good on-road gas car.
- Also great for beginners: the engine starts easily and is easy to tune.

dislikes

- The shocks do little to keep the car planted. The vertical arrangement of the rear shocks made it impossible to get a decent amount of damping, even with very heavy oil.
- The plastic clutch bell looks as if it might melt if it gets too hot.

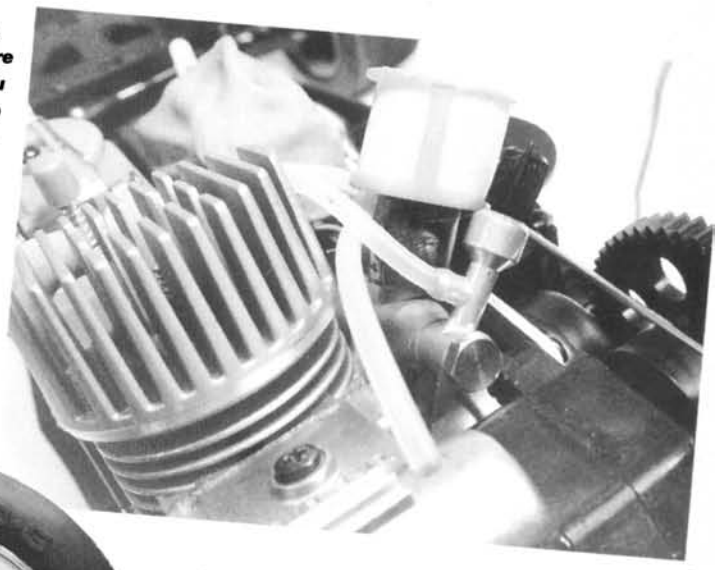
BUILDING AND SETUP TIPS

Because the 911 comes mostly assembled, there isn't too much to worry about when you build it. It's a gas car, so check all the nuts and bolts to make sure that they're tight, or engine vibrations might shake them loose.

The body has several molded plastic parts that must be painted separately before you can mount them on the body. The rear wing, wipers and mirrors should be painted with a glossy paint; don't use the paint you would use for Lexan bodies, because it dries flat. I used Model Master* Gloss Black for these parts, and I was very pleased with the way it covered and how shiny it was after it dried. For the clear body, I used standard Pactra Outlaw Black.

For the best possible cooling, I recommend that you remove the entire front windshield. I tried cutting out the door windows for a little air, but it still ran hot, so I cut the windshield, too.

Right: with the GS-11, setting the fuel mixture couldn't be easier. You use just one needle to set the main mixture. (The low-end mixture is set at the factory.) Below: a nice fat set of slicks is included with the 911. The rims are chrome-plated plastic, but they look like expensive machined-aluminum rims.



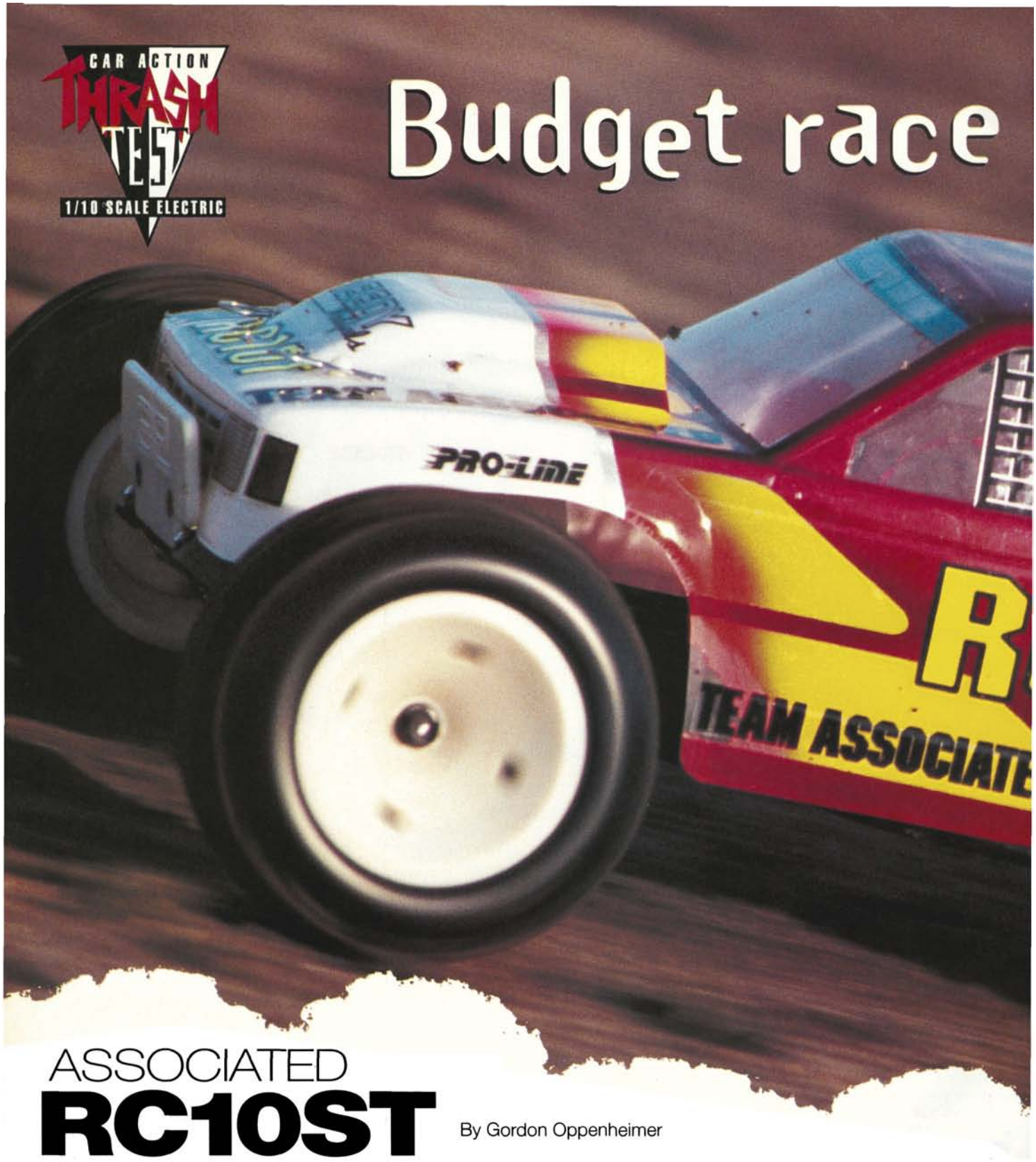
FINAL THOUGHTS

All in all, I liked the Porsche very much. The suspension needed a little work, but when I replaced the shocks with Kyosho's Ultimate shocks, that problem was solved. The GS-11 started and ran well, and it provided enough power to do some 360-degree burnouts. If you're looking for a good on-road gas car for fun-runnin', take a look at the 911.

**Adddresses are listed alphabetically in the Index of Manufacturers on page 169.* ■

CAR ACTION THRASH TEST 1/10 SCALE ELECTRIC

Budget race



ASSOCIATED RC10ST

By Gordon Oppenheimer

I WAS EXCITED when the editors of *R/C Car Action* finally gave in to my months of pestering and presented me with the entry-level 1/10-scale Team Associated* RC10ST Sport Truck to review. It's a relatively inexpensive bushing version of Associated's winning RC10T Team Truck. As Air Age Publishing's computer guru/systems manager, I help them squash their computer bugs and, in the process, I see them test a lot of vehicles. It looked as if they were having a ton of fun, so I really wanted to try it, but I didn't know the difference between a differential and a suspension arm. I figured it was time to find out....

This was my first venture into the R/C world, but I planned to complete the assembly in just a couple of nights. I opened the box and pulled out a 60-page instruction manual and two dozen sandwich-size plastic bags, each filled with a jumble of parts, most of which I didn't recognize. I was overwhelmed. I hadn't realized how much went into an R/C vehicle, but my fear was short-lived.


truck with bite!
C10T
1
TEAM ASSOCIATED

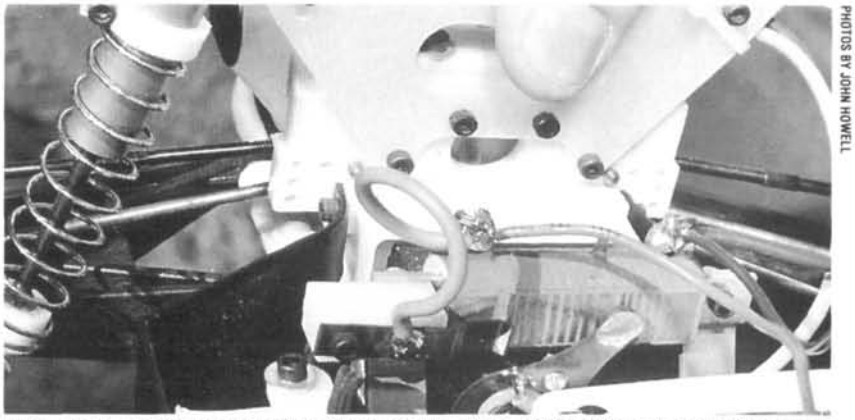
BUILDING AND SETUP TIPS

At first, the assembly looked as if it might be slightly beyond my novice skills, but when I started reading the detailed instructions, I realized that everything would go smoothly. The instructions tell you how to set up your work area, and they include photographs of each step. In addition, next to the pictures of the parts, there are full-size drawings to make sure you know the correct part to use.

I did make mistakes though: I didn't get the optional tools suggested in the manual. For example, the kit includes all the Allen wrenches you need, but for speed, they recommend a straight Allen wrench with a T-handle. This would have been handy for all the times I had to screw and then unscrew an incorrectly installed part.

I also had a bit of difficulty with the nylon parts. As recommended, I trimmed off the extra flashing, but the parts didn't always fit together smoothly. This was especially evident while I was connecting the shocks to the front A-arms. I really had to work at it before they fit.

A big plus is that the bags of parts are all numbered, and they're mostly used in order, so you only have two or three bags open at a time. Despite this, I couldn't find the E-clips. I was looking for a bunch of individual clips, but I found them taped together in a group of about 10. Fortunately, I had an expert nearby who could tell me what to look for. I highly recommend that you make friends with an experienced modeler if you have never built before! Just a few tidbits of information can really make the building process much smoother.



PHOTOS BY JOHN HOWELL

This close-up of the speed control shows it's a little different from the usual three-step resistor controller. It's a wiper-type controller that offers smoother throttle response, although it doesn't have reverse.

Everything about the kit, from the detailed instruction manual to the three-piece rims, was well-designed.

Specifications

Scale	1/10
List price	$240
DIMENSIONS	
Overall length	15.75 in.
Wheelbase	11.375 in.
Front width	12.375 in.
Rear width	12.5 in.
WEIGHT	
Gross (ready to run)	4 lb., 2.51 oz.
CHASSIS	
Type	Tub
Material	Aluminum
DRIVE TRAIN	
Type	Gear
Primary	Pinion/ spur
Transmission	Gear
Differential(s)	Ball diff
Slipper clutch	Friction slipper
Bearings/bushings	Bushings
SUSPENSION (F/R)	
Type	Lower A-arm/upper link
Damping	Oil-filled coil-over shocks
WHEELS	
Front (type)	Three-piece plastic
Dimensions (DxW)	2.2x2
Rear (type)	Three-piece plastic
Dimensions (DxW)	2.2x2
TIRES	
Front	Staggered ribs
Rear	Paddle/spike
ELECTRICS	
Motor, battery, ESC	Reedy Mr. Outlaw stock motor and variable mechanical speed control included.

KIT FEATURES

Equipped with bushings, the RC10ST is an entry-level kit based on Associated's national-race winning truck; it's also similar to their 2WD buggy, the RC-10. The truck is perfect for novices who want to get into R/C but don't want to start over if they decide to step up to competitive racing. Upgrading to pro level will require a few new parts—bearings, an electronic speed control, hard-anodized shocks and a high-performance motor.

The truck comes with the Stealth transmission—a unit that's well-known for performing admirably on the track. It contains three, 48-pitch gears (with a 2.25 reduction ratio), a friction slipper clutch and a ball differential. It's light, compact and relatively easy to build and install.

The 10ST has the same light aluminum chassis as the Team Truck 10T and RC10 buggy. It's also equipped with fiberglass shock towers and Teflon-coated Gold shocks. The high-bite tires are joined to three-piece rims, so there's no messy gluing to be done. It has long A-arms for stability and a turnbuckle linkage system for easy camber and toe adjustments.

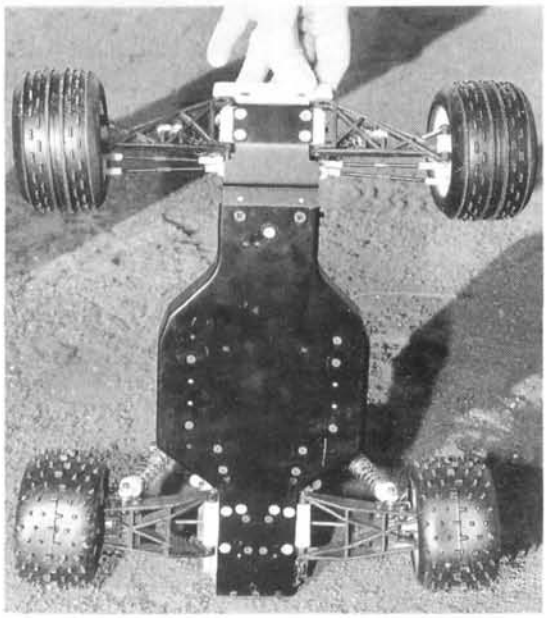
An included Reedy stock motor is connected to a mechanical speed control. With this setup, the battery holder

FACTORY OPTIONS

- Hard-anodized shocks, 1.32 or 1.02—part no. 6431 or 6432.
- Ball bearings, complete set—no. 7700.
- Reedy Elite stock motor—no. 6503.

THINGS YOU'LL NEED

- 2-channel radio with two servos.
- Battery pack.
- Battery charger (optional, but recommended).



The chassis used on the RC10ST is the same as the ones on the RC10T Team Truck and the popular RC10 buggy; it's a reliable unit.

was installed laterally, i.e., across the truck. The battery packs fit a bit too snugly, and I wound up stripping the connector wires. I thought that perhaps I could get shorter packs that would fit better, but when I showed this to the experts in the office across the hallway, they showed me a small notch in the battery packs through which the wires fit without rubbing on the holder—duh!

TEST GEAR

The truck comes with just about everything you need to get up and running, so you only need to buy a radio system and a charger unit. The 10ST comes with a charge cord, but I recommend that you spend a couple of extra bucks and get yourself an inexpensive AC/DC wall-unit-type charger. The included cord will work, but you have to charge off your full-size car battery, and there's no timer to stop the charging.

I chose an Airtronics* Rival, 2-channel AM radio, which comes with two servos. I really like the trim knobs and the sliding cover that protects the antenna when it's down.

To charge my battery pack, I use a Hobbico* AC/DC Auto-Charger. It can be plugged into a regular wall outlet, and it has alligator leads that allow you the option of charging your battery from a full-size car battery—very useful when you venture off-road. It has a 15-minute charge timer for fast charges and an overnight trickle-charge feature for maximum power.

PERFORMANCE

Once again, in my eagerness to get going, I didn't read the instructions as carefully as I should have. I plugged in the batteries without first turning on the transmitter. The truck nearly zoomed out of my hands and off my worktable. Luckily, I had a firm grip and quick hands, and I disconnected the batteries. An extra line in the instructions could have saved me from nearly crashing the RC10ST before its first run.

During my first test (in a parking lot) I found the RC10ST constantly pulling to the right. This was easily fixed with some small adjustments to the radio trim. Next, being new to R/C, I was curious and wanted to test the range of my radio. I figured I'd run it until it was out of range and had stopped. I'd then walk into range and drive it back. After my first mistake, you'd think I'd realize that it wouldn't stop.... Luckily, it hit a curb instead of the wheels of a moving automobile. The front nose plate did its job, and there was no damage.

For my next test, I found some very coarse gravel. The truck treated it the same as pavement. I tried high-speed turns, quick starts and full-speed runs. It bounced a little, but its performance was excellent, even though I wasn't running it on a smooth, track-like surface.

Finally, I took it to dirt. This was the most fun; dirt flew as soon as I hit the throttle. I made a small jump out of an old piece of plywood, and there was a lot of junk around—leaves, rocks, sticks and assorted boards. When I had learned how to steer, I could get the truck to follow any route I wanted. Even over the jump, the truck didn't miss a beat; it ran as straight and evenly as if it were on a flat surface.

I plan to run my next test on the track against some competition. I'm not much of a driver, but I think the RC10ST will help me be competitive.

likes

- **Based on the RC10 chassis; lots of after-market parts for it.**
- **Easily upgradable to full-blown race truck with a few factory options.**
- **Great suspension handles the roughest terrain.**
- **Included speed control provides smooth and reliable throttle.**

dislikes

- **Mechanical speed control can be a little tricky to set up for first-timers.**
- **Some parts fit tightly, and that made assembly tricky.**

FINAL THOUGHTS

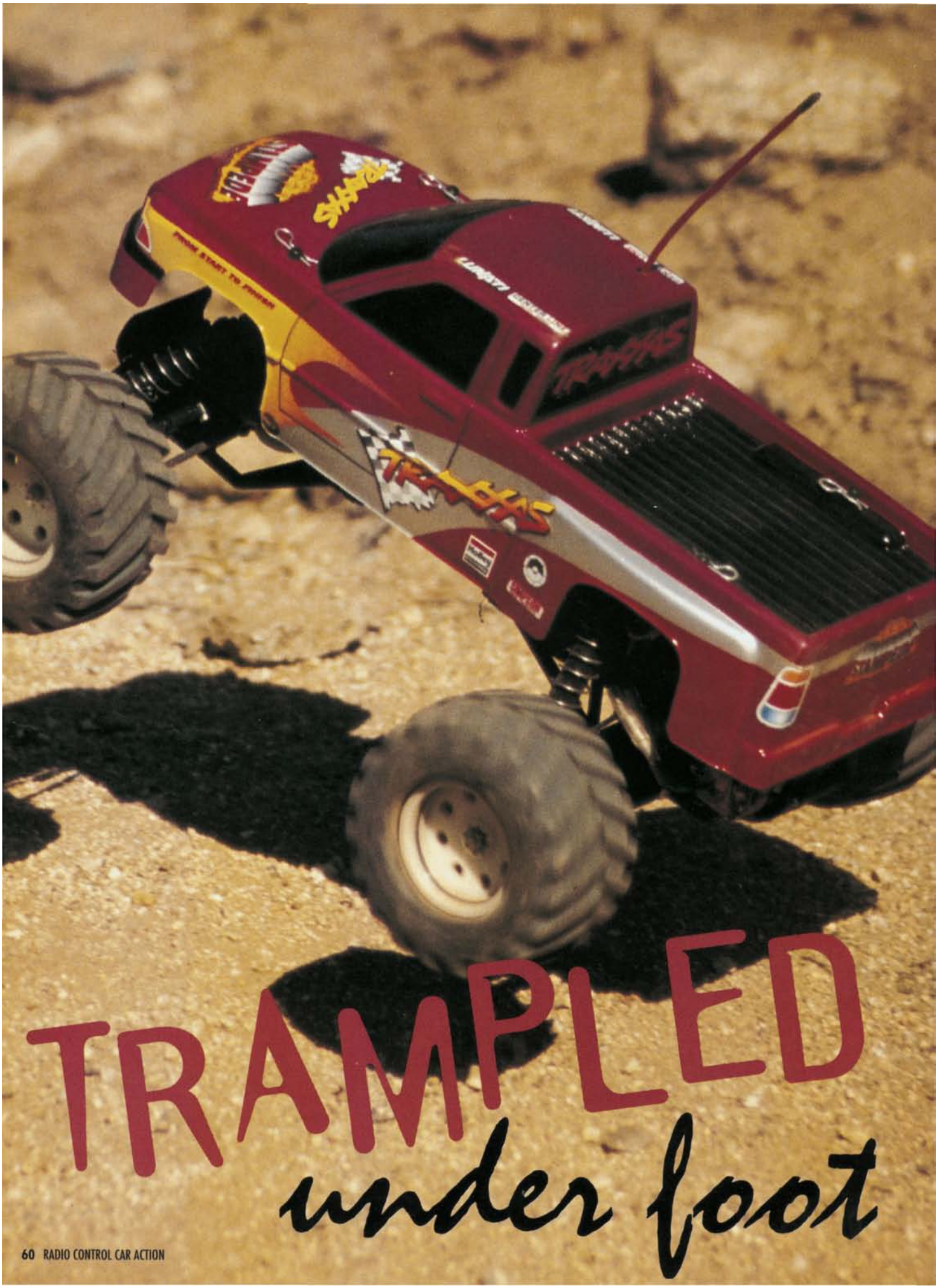
The Associated RC10ST truck easily pulled through all my mistakes—a feat a lesser truck might not have accomplished. It was just as much fun to assemble as it is to run. It can easily be upgraded and made into a high-performance racer, but it's quite speedy right out of the box. If you're looking for an entry-level truck and you might want to race someday, the Team Associated RC10ST truck is for you.

**Addresses are listed alphabetically in the Index of Manufacturers on page 169.* ■

The Competition

	Rustler	Junior-T	RC10ST	Club 10 Storm	MT 10S
Wheelbase	11.625 in.	11.25 in.	**11.375 in.**	12.90 in.	13. in.
Width	12.125 in.	12 in.	**12.50 in.**	12.04 in.	13 in.
Weight	4 lbs., 3 oz.	3 lb., 15 oz.	**3lb., 15.40 oz.**	3 lb., 7.58 oz.	4 lb,.2 oz.
Diff type	Planetary gear	Ball	**Ball**	Ball	Ball
Chassis	Composite plastic	Composite plastic	**Aluminium**	Aluminum	Composite plastic
List price	$150	$139.95	**$240**	$189.50	N/A
Available at*	$89.99	$74.99	**$119.99**	$110	$110
Reviewed in	To come	12/91	**3/95**	To come	To come

*Prices vary with location.


TRAMPED
under foot

CAR ACTION THRASH TEST 1/10 SCALE ELECTRIC

Traxxas Stampede

by George Gonzalez

THERE'S A STAMPEDE heading toward your local hobby shop; and I'm not talking about cattle, buffalo, or any other kind of mammal that travels in a herd. I'm talking about Traxxas's* all-new monster truck—the Stampede. After driving this truck, I'm certain that a herd of Traxxas Stampedes could be as devastating as any herd of animals.

KIT FEATURES

An extremely narrow, fiber-composite tub chassis sits high above the front bulkhead and transmission and gives the Stampede an amazing 4 inches of ground clearance. The tranny and front bulkhead are supported by molded lower cross-braces that work like skid plates and protect the components.

On all four corners there are extra-long A-arms with molded upper control links, as well as extra-long, molded coil-over shocks. The molded shocks may not be the high-tech kind, but they work extremely well, and they never leaked during my "Thrash Test."

The shocks are easy to assemble because they don't have C-clips and because, like the more expensive unit, they feature double O-ring seals and rubber diaphragms. The shocks also come with interchangeable pistons (for precise tuning) and quick-release spring collars (to ensure accurate spring-rate adjustment).

Most of the suspension components are molded out of fiber-filled nylon (the same high-tech material that's found on the SRT and TRX-3) and are extremely rigid and tough. Because of the Stampede's super-low price, bearings couldn't possibly be included in the kit; Traxxas does, however, include a complete set of Oilite bushings instead of those funky, plastic units that are found on other trucks.

The Stampede's centered-kingpin, live-axle, front caster blocks are really trick. The front axles have drive pins that are mounted on the front wheels; this forces the axles to rotate inside the wheel bushings instead of having the wheel bushings rotate around the axles. According to Traxxas, the result is better cornering and increased stability.

The Stampede uses a simple, but effective, steering system: an upside-down servo with a heavy-duty servo-saver attached to it protrudes through the chassis and is connected to the steering rods. This setup allows steering rods of equal length to be used, and thatprovides an even left-to-right throw, but some bump steer is noticeable. The servo is also exposed to the elements, mainly water or mud, and that could lead to early servo failure (unless you have a moisture-proof servo).

The Stampede's tranny is based on the race-proven design of the Magnum 272. A three-gear format ensures smooth, friction-free operation, while a bulletproof, metal-

likes

- Excellent handling for a monster truck.
- Awesome-looking Dodge Ram body.
- Speed control and motor included.
- The telescopic, universal-joint drive shafts are a nice touch.
- Excellent instruction manual.
- Ridiculously low price.
- Impressive list of hop-ups.

dislikes

- No ball diff.
- No slipper clutch.
- Molded upper links prevent camber from being adjusted.
- Weak, flimsy body mounts.

SPECIFICATIONS

Traxxas Stampede

Scale	1/10
Price	$100 Model 3601 (unassembled kit) $175 Model 3610 (fully assembled)

DIMENSIONS

Overall length	16.75 in.
Wheelbase	11 in.
Front track	10.25 in.
Rear track	10 in.

WEIGHT

Gross (ready to run)	4 lb., 8 oz.

CHASSIS

Type	Molded tub
Material	Fiber-filled nylon

DRIVE TRAIN

Type	Gear
Primary	Pinion/spur
Transmission	3-gear
Differential	Planetary gear
Slipper clutch	None
Bearings/bushings	Oilite bushings

SUSPENSION (F/R)

Type	Molded upper links, lower A-arms
Damping	Molded, oil-filled, coil-over shocks

WHEELS (F/R)

Type	One-piece nylon
Dimensions	2.2x2.0 in.

TIRES (F/R)

Type	Rubber, terra-type monster truck tires
Dimensions	4.5x2.4 in.

ELECTRICS

Motor	Stock 540, closed endbell
Battery	6-cell stick pack (not inc.)
Speed control	Mechanical, rotary-type (w/ sealed contacts and several transistors)

PHOTOS BY GEORGE GONZALEZ

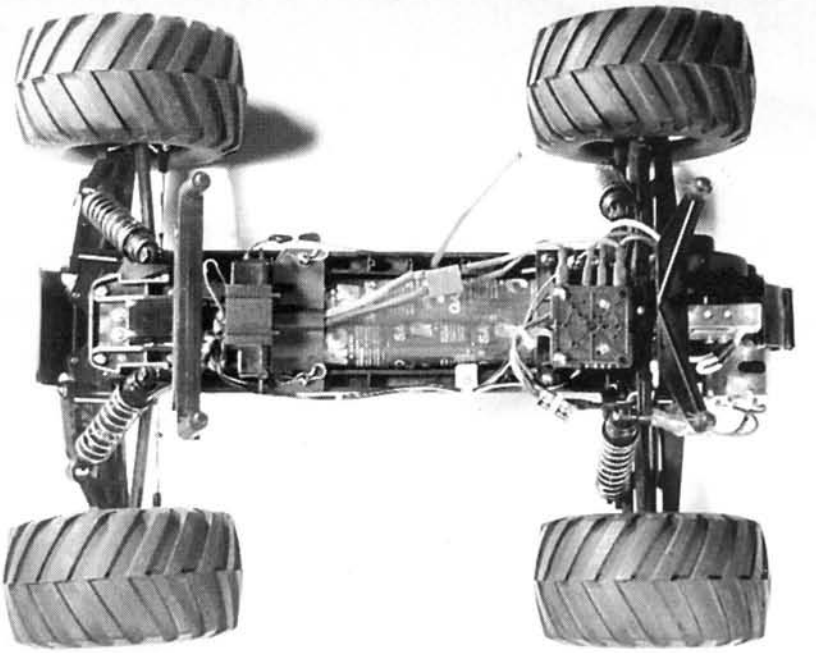
Things You'll Need

Model 3601 (kit form)

- 2-channel radio system
- 6-cell battery pack
- Battery charger

Model 3610 (fully assembled)

- Eight AA batteries for the transmitter (alkaline or Ni-Cd)
- 6-cell battery pack
- Battery charger



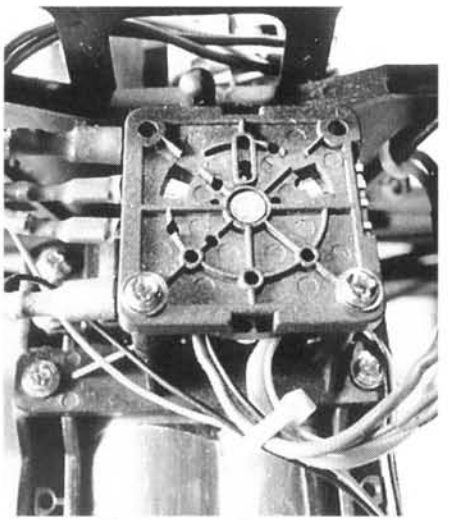
A fiber-composite tub chassis is the Stampede's backbone. To help lower the truck's somewhat high center of gravity, the battery lies flat in a recess in the chassis. Aggressive-tread tires help to motivate this machine over the gnarliest of obstacles.

Factory Options

- Ball-bearing set—part no. 4608
- Front turnbuckles (62mm)—3139
- Rear turnbuckles (72mm)—2335
- Rod ends with hollow ball connectors—2742
- Ball diff (complete)—2520
- Slipper-clutch set (complete)—4615
- Hardened-steel drive yokes with U-joints—4628
- Long, hard-anodized front shocks—2660
- Extra-long, hard-anodized rear shocks—2662
- Machine-cut racing gears—1995X, 1996X, 2519X (for use with optional ball diff)

Building and Setup Tips

My Stampede arrived fully assembled, so I can't give you any hardcore assembly tips. As far as setup tips go: the camber is fixed, there's no ball diff to adjust and there's no slipper clutch to set. So just do a wheelie!



The supplied mechanical speed control provides extremely smooth throttle response through all speeds.

gear diff provides reliable, maintenance-free performance. A set of telescopic drive shafts with universal joints is also on the list of standard equipment. A ball diff and a slipper clutch are not included, but they are on the list of hop-up items.

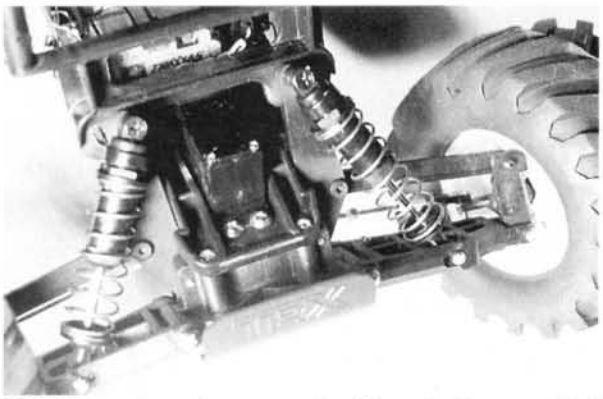
The Stampede's wheels are of the popular 2.2-inch size, so finding replacements or alternative treads is no problem. Also, the wheels can be dyed to get that really trick look. The supplied, aggressive-tread, monster truck tires work well on grass, gravel, asphalt and loose dirt, and they actually take some of the load off the shocks by absorbing the smaller bumps.

The Stampede's molded Lexan body is modeled after the daring style of the '95 Dodge Ram's. It's meticulously detailed, and it covers the chassis so that none of the electronics are exposed; this contributes to the Stampede's true-to-scale appearance.

The Stampede is available in two versions: as an unassembled kit (Model 3601) that includes a 540 motor and a 3-step mechanical speed control with reverse; and fully assembled (Model 3610), with the motor, speed control and a 2-channel radio system installed. Both kits are competitively priced—bargains, in my book.

TEST GEAR

I received the fully assembled kit, which included a Traxxas model 2020 2-channel transmitter, a 27MHz AM receiver and two standard 2018 servos. The only thing I had to supply was a 6-cell battery pack. For the first few test runs, I used the electronics that came with the kit. I later added a Tekin* 420 G2 ESC, a Trinity*/Kinwald 15-turn triple



Rigid, extra-long A-arms work with extra-long, molded coil-over shocks to handle just about any terrain that's thrown their way.

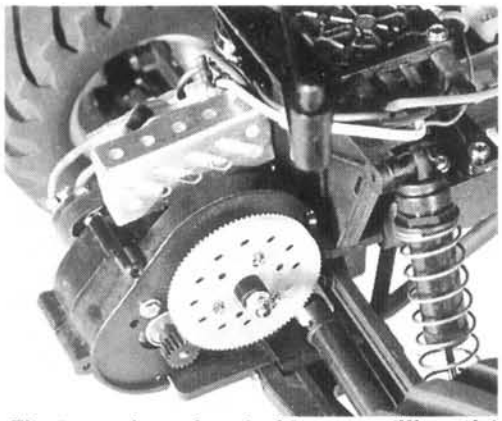
modified motor, a Hitec* HS-615MG high-torque steering servo and an Orion* turbo-matched 6-cell battery pack—just for the heck of it.

PERFORMANCE

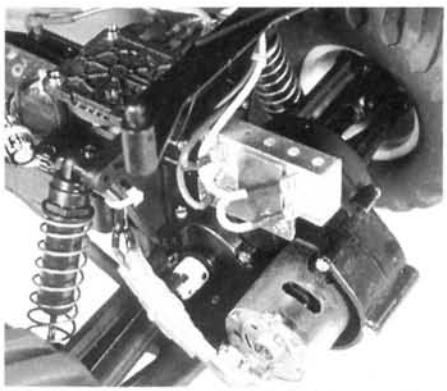
After I had lined up a few charged battery packs on my workbench, I opened my garage door and let my Stampede loose, ready to take on the perils of my front yard. It handled equally well on grass, dirt and gravel, and there wasn't an obstacle in my yard that the truck couldn't roll right over or knock out of the way. The kit's supplied electronics worked extremely well. I was especially impressed by the mechanical speed control; the power transition between speeds was extremely smooth in both forward and reverse, and the unit seems to be built to last. The word "brisk" best describes the truck's get-up-and-go with the stock electronics, and it wasn't long before I was craving more power.

For my next test session, I installed some high-tech electronics (refer back to "Test Gear"). The park up my street was like a wide-open frontier for my hopped-up Stampede, and soon I had a crowd of onlookers raving over the Stampede's performance. I found a huge oak tree with exposed roots and ran the Stampede right through them at full speed. Its suspension and tires soaked up the bumps time and time again, and never once did the truck lose its composure.

The Stampede also handles extremely well compared with other monster trucks. I was taking corners that would send others a rockin' and a-rollin'. The extra-long A-arms, coil-over shocks and live-axle front suspension are responsible for the truck's excellent handling, and handling has never been a priority on a monster truck—until now.



The tranny is equipped with a gear differential instead of a ball diff (though an optional one is available from Traxxas). Telescopic drive shafts with universal joints are also standard.

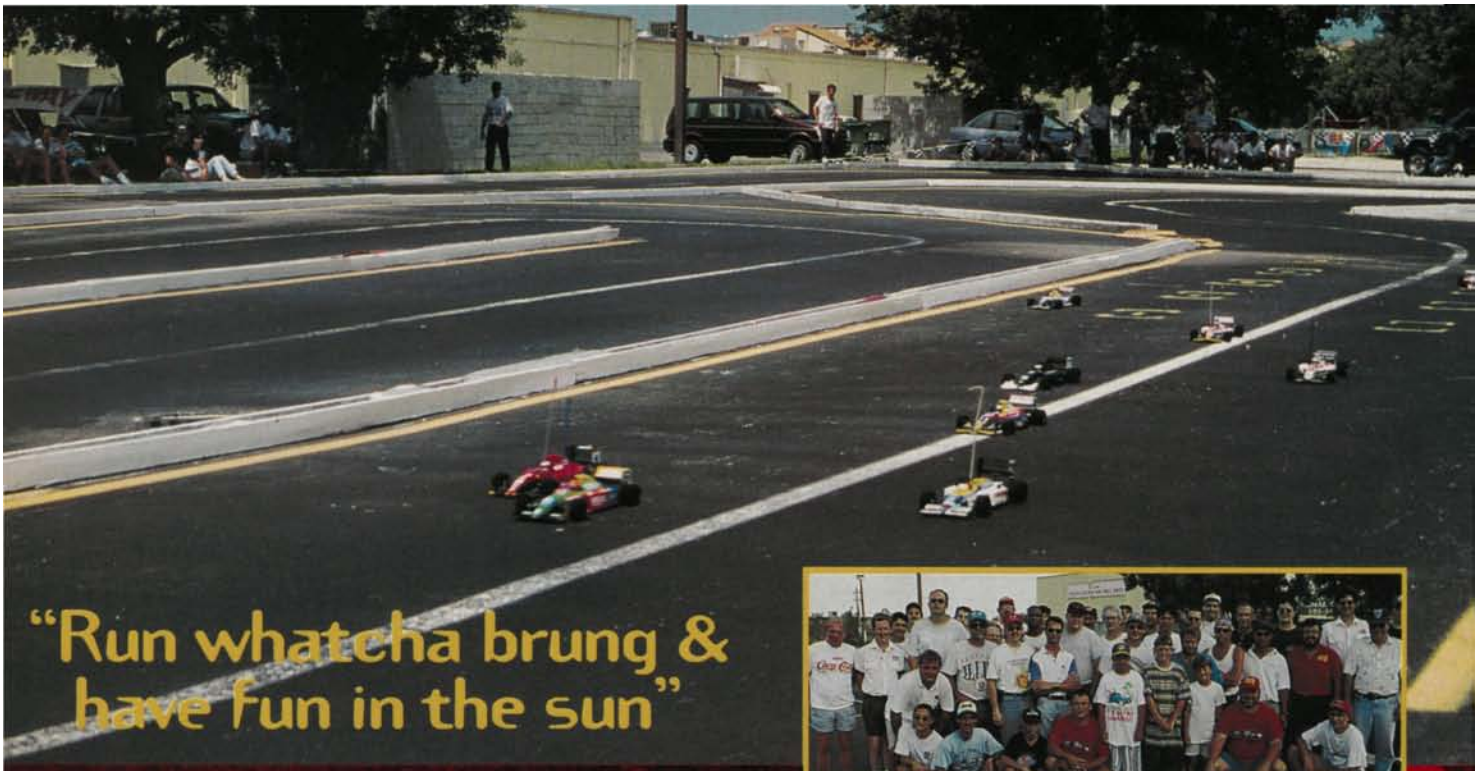


Out back, nestled underneath the mechanical speed control's resistors, is the truck's transmission, which is based on the race-proven Traxxas 272 3-gear transmission.

FINAL THOUGHTS

The Traxxas Stampede is a wise investment for anyone who would like to get started in R/C but who doesn't want to cash in a T-bill in the process. The Stampede's rugged design won't leave you stranded, or have you scrambling to the hobby store to pick up replacement parts after every thrashing. The Stampede's excellent performance will give you hours of pure R/C satisfaction, and any terrain is fair game for this monster truck. So what are you waiting for? Join the herd (before you get trampled).

**Addresses are listed alphabetically in the Index of Manufacturers on page 169.* ■



"Run whatcha brung & have fun in the sun"

by RICK SCHWARTZ

Tamiya America R/C Championship Series

Left: The top qualifiers (left to right)—Ray Martinez—F1 Stock; Pat Butler—Sedan Modified; and Edgar Delgado—F1 Modified.

"WHERE HAVE you guys been? I sent you to the store over an hour ago." "Sorry, Mom. Dad and I stopped over at Andy's Hobbies. They had this really neat R/C race. The cars were just like Indy and Formula cars. They even had four-wheel- and front-wheel-drive sedans. The best part was that they had demonstration cars that Dad and I got to try out. It was a blast! Now I know what I want for my birthday."

More than one passerby was drawn to the Tamiya* R/C Championship Series Race last July at the Miami R/C Speedway. Traffic into and out of the parking lot was continual, as local residents stopped to see what the event was all about. What they saw was parking-lot racing at its best.

BACK TO BASICS

Sponsored by Tamiya America, this race was number four in a series of 12. The race, which had no entry fee, showcased F1 and Indy cars in one class and 4WD and FWD in another. The racers were divided into two divisions: Stock and Modified. The stock cars were exactly as their name implied—pure stock, out of the box, with absolutely no changes. The Modified class allowed some alterations, but there were still some strict Series requirements. Each racer was given a handout Sanyo* N1400 SCR battery, which they were allowed to keep at the end of the day.

Here are the winners (left to right): Pat Butler—4WD/FWD Modified; Adam Shahan—4WD/FWD Stock; Edgar Delgado—F1/Indy Modified; and Ray Martinez—F1/Indy Stock.

FUN IN THE SUN

Because this competition lasted only one day, practice time, Qualifiers, Mains and

award presentations all had to be completed before the sun went down or the rains came (a frequent southern Florida occurrence). Tamiya representatives Eric Sands and Gary Demory teamed up with the track's owner, Pat Butler, and his crew, to ensure that the event ran smoothly with few, if any, glitches. So, with an atmosphere that was relaxed and friendly, the racers registered and friends and relatives set up picnic tables for a day of family fun.

GENTLEMEN, START YOUR ENGINES

There were two Qualifying heats. Formula 1 Stock was the first group out, followed by Formula 1 Modified and, last but not least, 4WD and FWD sedans. The track was fairly large—180x70 feet. This made for great racing because, as the drivers settled into their rhythms, they had enough pavement to race against the clock instead of having to fight one another for position.

During the Qualifiers, the Tamiya reps gave door prizes to the racers and the spectators—a nice touch that the non-racers really appreciated. At the conclusion of the Qualifiers, Ray Martinez was the top Stock Formula driver, with 16 laps in 5:10.65 with his Lotus F-103. Edgar Delgado was the fastest racer of the day in Formula Modified; he drove his Ferrari 643 F-103 18 laps in 5:07.01. The Stock Sedan class was led by Jack Acosta and his 4WD Alfa-Romeo, with 13 laps in 5:23.66. The final TQ of the day was captured by the owner of Andy's Hobbies, Pat Butler, with a modified 4WD Alfa-Romeo; he turned 15 laps in 5:23.42.

After the TQs had been decided, one more semifinal was held in each class to determine the top five racers in each.

Kudos to Tamiya

Our new word for the day is "kudos." According to Webster's dictionary, it means: honor, glory, credit, as for an achievement. Tamiya America surely deserves kudos for its new R/C Championship Series. We all know that manufacturers are in business to sell cars. Tamiya America, though, has decided to return some of its profits to the racers—in the form of this Series. Tamiya does the organizing and provides the trophies and the prizes; but more important, Tamiya allows new drivers to compete in a *pure* stock class that keeps their interest high, but expenses to a minimum.

By requiring that modifications be kept to a minimum and by spelling out what those modifications can be, Tamiya has assured us that novices won't be discouraged because they can't buy the latest upgrade. When a pure stock racer competes against a pure stock racer, the determining factor will usually be driving skill. Too often, beginners think that speed is all that they need to win, so they never learn how to drive properly; and all too often, beginners walk away from a track, never to return, because they feel they can't compete. Tamiya America has encouraged the occasional racer to move off the driveway and onto the track by putting him on equal ground with the advanced driver. Thanks, Tamiya America, for giving R/C racing the chance it needed!

The winners went on to the biggest races of the day—the A-Mains.

WINNER TAKE ALL

To make the final race of the day as interesting as possible, the Stock and Modified drivers ran in the same race. In the Formula class, Modified TQ Edgar Delgado continued his dominance, winning with 17 laps in 5:03.27. Stock TQ Ray Martinez showed his competitive skills by winning his class and finishing second overall in the Formula division—only 3 seconds behind Delgado. The 4WD and FWD Modified trophy was taken home by TQ Pat Butler. Even with all of the pressure on Pat, as a race sponsor and track host, he hung tough, calmed his nerves and drove like a champion.

Stock 4WD and FWD produced the only upset of the day, as Adam Shahan drove his Castrol Civic past TQ Jack Acosta to win. As thunder clouds threatened, the winners were given their trophies and awards, which included new car kits from Tamiya. It was a great day of racing that was back to the basics—simple, inexpensive fun for the whole family.

The Time Machine

Every sport has a history to it, even a fairly new sport like R/C racing.

Most of the time, though, when you go to a race, you only see the *latest* technology—the newest cars, the hottest batteries and the most advanced electronics. At this race, however, Ned Abbott, a model builder from West Palm Beach, provided a look into the past with his display—four Tamiya racers from the '70s and '80s. Ned is a big Formula 1 fan who has been building models since 1955 and who, in his younger days, raced a full-size Ferrari 250 GT SWB on the Sports Car Club of America circuit.

The cars Ned displayed included: a Rothman Porsche 956 (1985); a John Player Special (built in 1981); a Ligier JS 9 (1979 vintage); and his favorite racer (and one of the most interesting I've ever seen), a Tyrell P-34 six-wheeler (built in 1978). Talk about detail! Ned spoke to the car's builder, Ken Tyrell, to ensure that he'd have the correct color scheme.

Looking at these racers and comparing them with the Tamiya cars of today, we could see the vast improvements. In their day, though, they were top-of-the-line, and I'm sure that with some serious tweaking, they could be competitive today. Ned was impressed with the changes that have taken place over the years, and he feels that the new cars are light years ahead of his racers.

Is newer better? Maybe. But when I look at these cars from the past, I get a real urge to throw in a battery and start a vintage racing class. ■

Motor 101

by Stan VanDruff

ELECTRIC MOTORS are the most varied and mysterious of R/C electronics. There are dozens on the market, and after-market parts and tips for improving their performance abound. With so many variables, few people can become experts, but it's important to learn how motors work so that you can optimize your particular setup.

Most R/C motors are *two-pole, three-loop, permanent-magnet, direct-current.*

Two-pole—they have two magnets.

Three-loop (or "three-slot")—there are three coils of wire on the armature.

Permanent magnet—they use real (permanent) magnets in the can.

Direct current—they run off batteries instead of household alternating current (thank goodness!).

BASICS

You may recall that a magnet's "like poles" (e.g., two positive poles) repel each other while opposite poles (i.e., a positive and negative pole) are attracted. Electromagnets behave in the same way. Whenever current flows through a copper wire, the wire becomes an electromagnet. So if you put a current-carrying wire between two magnets **(see Figure 1)**, the wire will be repelled by the magnets and will move in the direction of the arrow. Reversing the current reverses the magnetic field, and the wire will move in the opposite direction.

Now consider a copper wire that has been bent to form a loop. When you put current through this loop, one side of it will act like a magnet's north pole, and the other side will act like the south pole. If you put the loop between two magnets **(see Figure 2)**, one side of the loop will be pushed up and the other side will be pulled down. These opposite forces generate torque that will turn the loop. It will turn until it is straight up and down. Here, the magnetic forces balance out, and torque is zero. Since the forces are balanced—neither pushing nor pulling the wire loop—this is called the "neutral plane."

Inertia will actually carry the loop a little past the neutral plane, but the loop will quickly snap back. If you reverse the current just after the loop has crossed the neutral plane (before it snaps back), the loop's magnetic poles will be reversed, and the loop will go through another half turn (back to the neutral plane). Reverse the current every time the loop passes through the neutral plane, and you've got a motor!

A commutator and brushes **(see Figure 2)** automatically reverse the current every half turn. Each end of the wire loop is attached to a copper contact. These contacts make up the commutator, or comm. As the loop and comm spin, the contacts rub against the brushes. For half a revolution, one contact rubs the positive (+) brush and the other rubs the negative (–) brush. When the loop crosses the neutral plane, the contact that was touching the (+) brush now touches the (–) brush and vice versa. This automatically reverses the current.

IS IT REALLY THAT SIMPLE?

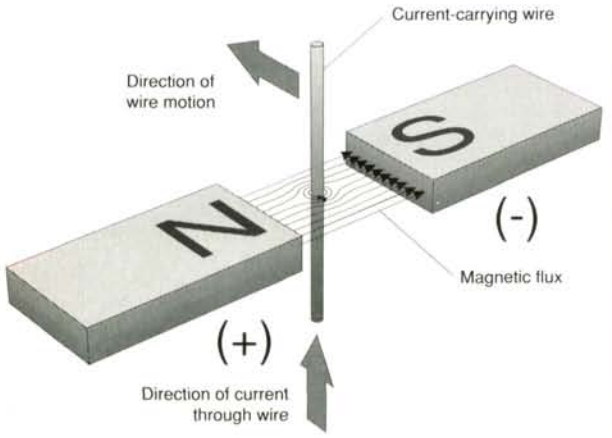
No, nothing is *that* simple. If the loop is in the neutral plane when you turn on the current, it won't develop any torque and the motor won't start. On the other hand, if the

ILLUSTRATION BY SCOTT ANGLE

Solving the Motor Mystery

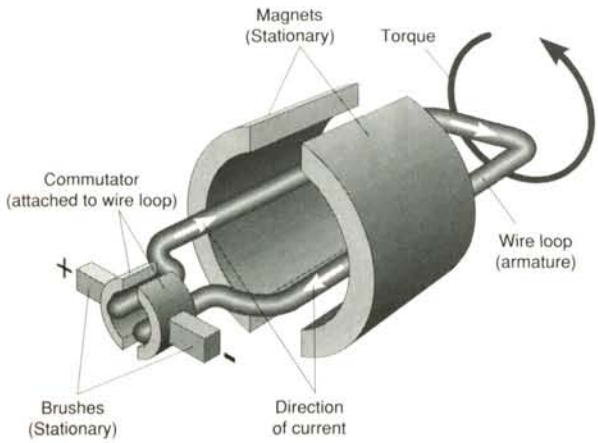
Motor Madness

FIGURE 1
Magnetomotive Force



ILLUSTRATIONS BY STAN VANDRUFF

FIGURE 2
Simple DC Motor



loop starts at exactly 90 degrees to the neutral plane, it's just as likely to turn clockwise as counterclockwise when you apply current. If you add a second loop at 90 degrees to the first, when one loop is in the neutral plane, the other will still develop torque, and the motor is guaranteed to start. It could still start to turn in either direction, though. If you add a third loop, two of them will always provide torque, and the motor will always start in the same direction **(see Figure 3)**. Any *odd number* of loops will do; and the more loops there are, the more smoothly power will be delivered. R/C motors usually have three loops to keep down the cost of the motor.

Of course, this copper wire isn't wound around thin air as shown in the drawing. It's wound around a core to concentrate the loops' magnetic flux (the magnetic field that exists around any current), making it stronger and more "directional." Cores have to be made out of a material that can be magnetized and demagnetized rapidly. Steel works well, but it's electrically conductive, so it converts some of the magnetism back into electricity (called an "eddy current"). This electricity wastes power, heats up the core and has no redeeming value whatsoever. (Trust me; the details would fill a chapter.) So steel cores are made of many layers (laminations) with air gaps between them that reduce conductivity and eliminate eddy currents. A steel core with a copper wire wound around it makes an armature.

The strength of the armature's magnetism is determined by how many turns of wire are in each loop and by the current flowing through each loop. Increasing the number of turns and increasing the current makes a more powerful motor. But for a motor of a given size, increasing the current usually means decreasing the number of turns of wire. To increase the current, you have to reduce resistance by using wire of a larger diameter or less, i.e., shorter, wire. ROAR stock motors have 27 turns of 22AWG wire ("AWG" stands for American wire gauge). Modified motors have seven to 20 turns, so the wire is shorter than in stock motors. Modifieds also use thicker wires. Although using fewer turns reduces magnetism, the increased current from thicker, shorter wires dramatically improves the power of a motor.

Another way to cram more current through a motor is to use multiple-strand windings. A builder can wind two to six smaller wires in parallel to make a double-, triple-, quad-, quint-, or sex-wind motor. Multiple windings use space efficiently, so manufacturers can use more copper per turn for more power.

MAKING A MAGNET

To operate, R/C electric motors depend on their permanent magnets, and stronger magnets make more powerful motors. Manufacturers can strengthen magnets by making them thicker and denser and by using stronger material. Motor manufacturers commonly use 4.5 to 4.9mm-thick magnets, and some use 5mm magnets. These thicker magnets are slightly stronger than the thinner ones, but more important, their inner surface lies closer to the armature (the diameter of the motor can is the same on all motors). The smaller the gap between the magnets and the armature, the more efficient a motor will be. Manufacturers can't make the magnets too thick, however, because imperfections in the armature could cause it to hit the magnets.

Magnets can only be made out of a few materials—iron, cobalt, samarium and other rare-earth elements. Magnets are often made of a combination of these, but the manufacturers of standard R/C motors avoid the expense of exotic materials, and ROAR rules forbid them. Magnets are molded using a process called "powdered

metallurgy." Magnetic materials are ground into a fine powder, then mixed with chemicals and molded (under tremendous force) into the curved shape you're familiar with. The molding is so accurate that machining isn't necessary. Some motors use strong "wet" magnets, but they aren't wet. Before being molded, the powder has been moistened with chemicals to make a denser magnet.

TIMING

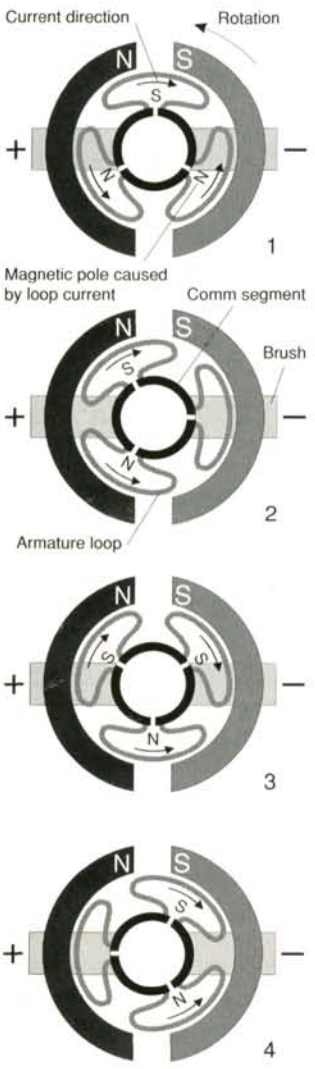
For maximum torque, speed and efficiency, the maximum strength of an armature's magnetic field must be where the magnet's field is at maximum strength. This is controlled by brush timing. Timing is determined by the angle between the center of the magnet and the center of the brush axis **(see Figure 4)**. You might think that the brushes should line up with the magnets (for a timing angle of zero), and when the motor is stationary or turning slowly, this is true. But as the motor turns faster, the ideal timing angle changes.

Two things make the timing angle change:

• It takes time to energize the magnetic field in the armature. When the commutator segments cross the brushes, the magnetic field from one loop collapses, and the next loop's field is energized. It takes a few ten-thousandths of a second to energize the field. When the motor is turning slowly, this would amount only to a fraction of a degree. A motor spinning at more than 30,000rpm can turn 20 to 40 degrees in this tiny fraction of a second! If timing were set to zero, the motor would soon reach a speed at which the field did not get energized until it was too late, and the motor's speed would never

FIGURE 3
Commutating Action

An armature loop can act as a north or south pole depending on the current direction. In fact, each loop changes polarity every half revolution. Arrows show which way the current flows through each loop and an N or S shows which pole it is. The three loops are wired so that two of them are always energized.



Follow each step below and try to imagine the armature turning from step to step. Once you understand this, you should be able to visualize what happens during the other 270°.

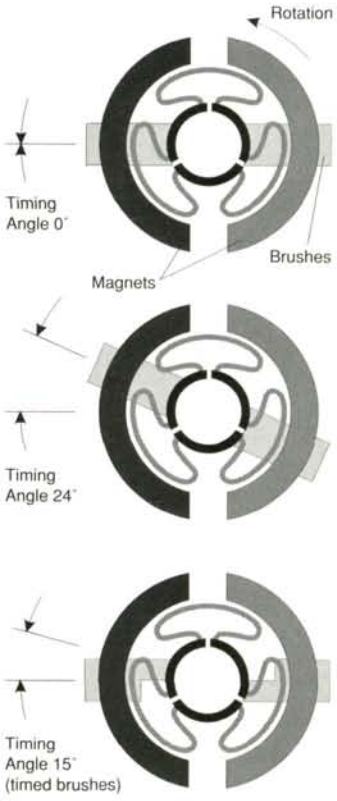
1) Current flows in through the (+) brush and out the (–) brush. On its way, it creates two north poles and a south pole. The north pole loops are repelled by the north pole magnet, and the south pole loop is repelled by the south magnet (remember, like poles repel while opposites attract). The motor turns counterclockwise.

2) At 30° rotation the (–) brush shorts out the loop that is now on the right and its magnetic field collapses. The other two loops continue to provide torque and turn the motor.

3) At 60° rotation current starts to flow in the third loop again, only this time in the opposite direction. It is now a south pole. This new south pole is repelled from the south magnet and adds more torque to the turning motor.

4) At 90° rotation, another loop is shorted out, this time by the (+) brush. Its field collapses, but the other loops continue to turn the motor.

FIGURE 4
Timing Angle



get even *close* to 30,000rpm. By advancing the brush timing, the field starts to energize sooner and the motor can go faster. Up to a point, the more you advance the timing, the faster the motor can go.

• The magnetic field inside the can changes with speed. As the motor spins, the armature's magnetic field reacts with the magnet's field, and this interaction distorts the overall field inside the motor case. In other words, as the armature spins, it changes the point at which the magnet's field is strongest. As the motor speeds up, the neutral plane drifts in a direction that's opposite to the direction of rotation, and timing has to be advanced even more **(see Figure 5)**.

Voltage, load, number of turns and the speed of the motor all play a part in determining the ideal timing angle. Most important, the optimum timing will change with the speed of the motor. When we advance timing to 30 or 40 degrees to improve the top end, the timing is way off for low-speed operation. In large industrial motors, timing is automatically adjusted while the motor is running, but we have to compromise. Keep in mind that even though high timing angles (up to about 45 degrees) boost top speed, low-speed torque and acceleration will suffer **(see Figures 6 and 7)**. And remember that extreme timing, which works well for stock motors, can make a high-current modified motor overheat.

THE MOTOR AS A GENERATOR

Generators and motors are practically identical; in fact, any motor can be converted into a generator. This property comes in handy in our hobby. On a dynamometer, a generator makes an excellent test load that can easily be varied. Measuring load and rpm is electrically simple.

We also use R/C motors as generators: the braking circuits on regenerative electronic speed controls actually use the motor as a generator when you apply the brakes. Your car is slowed down while the generator recharges the battery. On courses where you brake often, regenerative braking can noticeably increase run time. Some drivers think that regenerative brakes boost the battery voltage enough for them to get extra punch coming out of corners.

PERFORMANCE

Now you know how a DC motor works, so we're ready to discuss the factors that affect performance in more detail. As well as the factors already discussed, brushes, springs, heat, motor construction and maintenance also affect performance.

To make a motor run faster, you need to:

• increase the power you put into it ;

• improve its mechanical and electrical efficiency, i.e., eliminate friction. Shaft bushings are obvious sources of friction, but it can be dramatically reduced by proper break in, adequate lubrication and, possibly, the substitution of ball bearings for bushings—pretty simple. The other major source of friction is the brushes.

• **Brushes** carry current to the armature by rubbing on the commutator. They are made of copper, silver, or carbon (graphite).

—*Graphite* is very slippery and is used as a lubricant; pure graphite brushes would produce very little friction and would not wear the commutator. Power tools have graphite brushes that rarely have to be replaced. Graphite isn't an outstandingly good electrical conductor, though, and pure graphite brushes limit a motor's torque and speed.

—*Silver* is the best conductor available, but it's expensive and soft; so-called "silver" brushes aren't pure silver, because a pure silver brush would be too expensive and would be worn away in a single race, so a hard copper alloy is added to it. This harder material increases friction and makes silver brushes more damaging to commutators.

—*Copper*—hard or soft—is the major ingredient in all R/C brushes. Its conductivity falls between that of graphite and silver, and it's harder than both. Graphite and/or silver have to be added to copper brushes to improve their characteristics.

• **Cut brushes** have part of the face removed so that a smaller area touches the commutator, and friction is therefore reduced. (Note: friction is the force that makes it hard to slide one object over another. Contrary to popular belief, friction depends only on the material the objects are made of and how hard they're pressed together. Reducing area does not reduce friction. When you slide one very smooth object over another—like a brush and a comm—a molecular force called "adhesion" behaves similarly to friction. Adhesion is very dependent on surface area, so cutting down a brush reduces adhesion and lets the comm turn more easily.)

Timed brushes also have part of their faces removed, but they're made and installed in a way that will alter motor timing **(see Figure 4)**. The brush face is smaller and offset to the side that's opposite the direction of rotation. Since actual timing is measured from the center of the brush face, timing is advanced by adjusting the offset. (Timed brushes could, of course, be installed backwards to reduce the timing by the same amount.)

Not only do brushes encounter mechanical friction, but they're also the source of considerable electrical resistance. When you

FIGURE 5
Neutral Plane

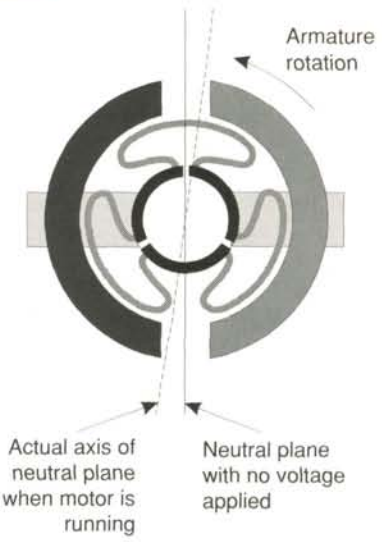


FIGURE 6
Power vs. Timing Angle

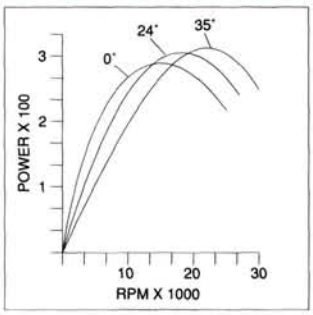
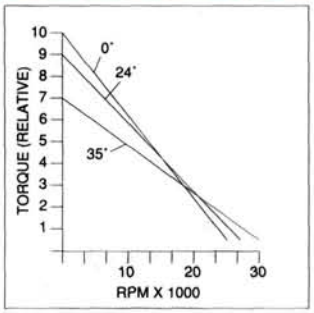


FIGURE 7
Torque vs. Timing Angle



HOW TO CHOOSE A MOTOR

You might as well face it: choosing the right motor is just plain hard! You'll see dozens of motors in ads—all claiming to be just what you need. Wire, wind, brushes, bearings, springs, magnets, timing and a few other factors determine how a motor will perform; the combinations number in the thousands. In short, it's impossible to choose the perfect motor the first time. No matter which motor you get, you should try different brushes and springs. On modified motors, you should also play with brush timing (stock motors do *not* have adjustable timing).

But you have a decision to make, so first decide whether you want a stock motor or a modified one. For backyard play, don't spend too much for a motor; it's just not that important. A stock motor will give you good speed and longer run times than a modified motor. If you're after wild wheelspins and jack-rabbit acceleration, try an Outlaw stock motor (18 to 22 turns), or a budget modified (15 to 19 turns). Low-turn modifieds (fewer than 12 turns) are wicked, but they can over-stress your speed control, batteries and wiring.

Stock motors are simple to set up and easy to maintain. Modified motors have adjustable timing so they can be more difficult to set up. But they can be disassembled for more detailed maintenance, and they're available with ball bearings. Modified motors are more expensive, but they can be rebuilt, so they last longer than stock motors.

If you plan to race, which motor classes are run locally?—probably modified or ROAR stock. Only a few tracks run non-ROAR stock classes. ROAR stock motors are limited to 27 turns of 22AWG wire and 24 degrees of timing. Within these specifications, manufacturers do everything they can to make each new motor faster than the last one. They up the ante every year.

If you race in a ROAR event, you *have* to use one of their approved motors—period. Choose the best one by checking what others use and reading reviews. Designs change quickly, and better motors appear every six months.

If you race in non-ROAR stock classes, here are a few pointers to follow when choosing a motor:

- Higher timing gives you more top-end rpm, but you give up low-speed torque. Highly timed motors are good for oval races in which speeds are nearly constant all the way around the track.
- Lower timing gives you more low-end torque for faster starts, but it may not give better acceleration out of the corners. These motors are best for tracks with very sharp turns in which your car almost stops and top end speed isn't that important.
- Motors with fewer than 27 turns will be faster and have more torque, but they'll place higher demands on your batteries. Cheap batteries may not last the full 4 minutes you need to finish a race.

If you race in the modified class, your choices (and wallet) are wide open. Modified motors are faster than stock, but they draw a lot more current, so you'll need expensive batteries to be competitive. Your car will be harder to handle, and you may not get more laps than the guys who run stock.

If you choose modified, here are a few things to keep in mind:

- Fewer turns mean a faster motor and shorter battery life.
- Modified motors have variable timing, so timing isn't a factor.
- You have to use an electronic speed control (ESC). Mechanical speed controls can't handle the high current needed by modified motors.
- Don't automatically buy the fastest motor you can find. Too much power may make your car impossible to handle.
- Modified motors have high initial cost, but unlike stock motors, they can be rebuilt.
- You can buy one motor and use different armatures to tune it for a variety of conditions.

If you've developed your driving skills to the max and you're serious about choosing the best motor for a given track, call one of the major motor manufacturers (Trinity*, Reedy*, Extreme Motorsports*). They all have people on staff who are experts in choosing motors. Just call with the physical details of your car and the track. Also try to find out the track record for laps turned and their times. These guys can help you to choose a motor (their brand, of course) that's as near to perfect as you can get.

Which Motor is Best?

Car	Turns										
	17	16	15	14	13	12	11	10	9	8	7
1/10 on-road—4 min.	–	–	–	–	■	■	■	■	–	–	–
1/10 oval—4 min.	–	–	■	■	■	■	■	■	–	–	–
1/12 on-road—8 min.; 6-cell	■	■	■	■	–	–	–	–	–	–	–
1/12 oval—5 min.; 6-cell	–	–	■	■	■	■	–	–	–	–	–
1/12 carpet—8 min.; 4-cell	–	–	■	■	■	■	■	–	–	–	–
1/10 off-road—4 min.; 6-cell		■	■	■	■	■	■	■	–	–	–
1/10 truck—4 min.; 7-cell	■	■	■	■	■	■	–	–	–	–	–
4WD dirt oval—4 min.; 7-cell	–	–		■	■	■	■	■	–	–	–
2WD dirt oval—4 min.; 7-cell	–	–	■	■	■	■	■	–	–	–	–
1/10 sprint car—4 min.; 7-cell	–	–	–	■	■	■	–	–	–	–	–
Drag racing	–	–	–	–	–	–	■	■	■	■	■
Truck pulling	–	–	–	–	–	■	■	■	■	■	–

reduce a brush's friction, you usually increase its resistance. Generally, a low-resistance brush carries extra current that more than makes up for the increase in friction (but the commutator will wear faster). Finally, there are conductive brush lubricants that you can apply to the brush faces to reduce friction and possibly lower resistance, too; try comm drops.

SPRINGS

Brush springs also affect friction and resistance. Stiff springs press the brush tightly against the commutator, increasing conductivity, friction and wear. The friction reduces top-end speed, but the lower resistance improves acceleration. Stiff springs also prevent the brushes from bouncing and arcing when the motor is subjected to heavy acceleration or a lot of vibration.

As a rule of thumb, use hard springs when acceleration is important, or the motor will be subjected to a lot of vibration, e.g., on roadcourses where there are many turns through which you have to accelerate, and in off-road cars that have to endure bumps and jumps that can cause "brush bounce." Soft springs are ideal when the motor will be run at a nearly constant speed on a smooth track, e.g., an oval or superspeedway. For more info, see brush selection chart, at right.

MOTOR BUILDING

How a motor has been built has a lot to do with how it performs. Most are machine-wound and have a single wire for each loop. Machine-wound motors are fairly uniform, but they aren't the best performers. When a builder winds a motor by hand, he can control exactly where each turn of wire goes. He can concentrate the turns near the center of the armature, or force the windings toward the outside of the armature to subtly affect performance. Hand-winding multi-filament wire allows the builder to squeeze much more current-carrying copper into a motor than any machine can.

On stock motors, builders often modify the armature core. Some use a slotted core that has two or three short laminated stacks with a gap between them. This configuration reduces rotating mass and increases cooling. Modified motors can use a short stack that allows the same number of turns to be fit in with shorter wires.

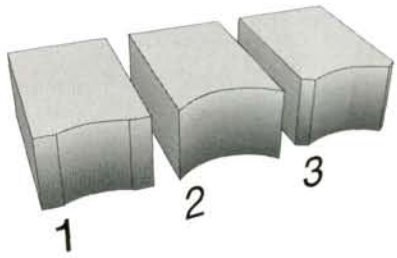
Depending on how a motor has been wound, the center of its magnetic field may not be exactly in the center of the magnets. A custom builder uses shims to move the armature a few thousandths of an inch toward the front or back of the can because he knows that, for maximum performance, the armature's magnetic field must line up with the magnet's magnetic field.

BREAK-IN

To obtain the best performance from your motors, proper break-in is important. Although a motor will run right out of the box, you'll reduce its life and compromise performance if you don't take the time to break it in correctly. Every racer has his favorite break-in method, and they all work well. The important thing is to get the brushes seated properly so that they don't wear the comm. Well-seated brushes have lower resistance and friction, so you get as much power from your motor as possible.

There are many ways to break in a motor, but you must always remember to let the brushes wear in gradually, and you must prevent the motor from overheating. Possibly the fastest and easiest method is water-dipping. Fill a cup with enough water to cover the motor. Submerge the motor and connect it to a 6-cell battery pack. Don't use a power supply because of the risk of an electric shock. Run the motor until the water turns gray (10 to 60 seconds). Remove the motor from the water and inspect the brushes **(see Figure 8)**. When they are fully seated, dry the motor with a heat gun (hair dryer) and motor spray.

FIGURE 8
Breaking-in Brushes



1. This brush is starting to break in, but is not making contact all the way across.

2. This brush is fully broken in.

3. As a last step, sharp corners have been removed with a file.

You can also break in your motor using a second motor. Connect the two motors with a 1-inch length of plastic tubing that fits the shafts snugly. Run the second motor in reverse so that your new motor turns in its usual direction. Trinity offers abrasive break-in drops that let you break in any brush in 5 minutes. They also offer brushes with a serrated face that's designed for rapid break-in without wearing the comm. Of course, you could just break in the motor in your car. You can have a little fun while you're doing this hard work. No matter how you do it, give it plenty of time, and don't run it at full speed until it has been fully broken in.

TESTING

You can't just read a book and then buy the ideal motor; there are too many variables to consider. The only way to obtain the ideal motor is to buy one that comes close and then build on it by trial and error (and I *don't* mean wild guesswork!). It's a long process because you can't change more than one thing at a time. If you change brushes *and* springs, for example, you won't know which change made your car faster. And don't go changing gears at the same time you are making motor changes.

Use a stopwatch, and take detailed notes; your memory is no match for a log sheet. Results can sometimes surprise you. If the stopwatch shows faster lap times, you've taken a positive step. If you go more slowly, don't trust what theory says. You may need to make tests over many runs to reach perfection. Experiment until you get the right gear for the track before you make changes to the motor. When you can't get the motor to go any faster, try changing a tooth in your gearing.

Contrary to popular opinion, dynamometers can't tell you when you have your motor tuned to the max. Most dynos designed for R/C don't give good *absolute* readings. They're best used to compare readings of different motors or different setups on the same motor. Once all your dyno data have been backed up by track test

BRUSH SELECTION CHART

	MOTOR BRUSH					
	HARD	SOFT	SILVER	TIMED	SLOTTED OR HOLLOW	CUT
	Copper/graphite: long wearing, handles high current; med. comm wear. Use light/med. springs.	Cooper/graphite: less comm wear, more power, more torque. Use medium springs.	Silver/copper: lowest resistance; most rpm, power, comm wear. Use heavy springs.	Copper/graphite or copper/silver: increases timing for stock motors.	Copper/graphite: better cooling and reduced drag. Try these where heat is a problem.	Copper/graphite or copper/silver: for low current uses. Lower drag, good on long tracks.
24° STOCK	Long wearing. Good for off-road, 4WD, 7-cell, and street racing	Standard brush for this motor.	Max. torque in stock motors. Watch for comm and brush wear.	More rpm and more power but shorter brush life.	Not recommended. No advantage.	Not recommended. No advantage.
34° – 45° STOCK	Long wearing. Good for off-road, 4WD, 7-cell, and street racing	Standard brush for this motor.	Greatest power, but replace every 2-3 runs.	Not recommended. Too much timing lowers performance and overheats motor.	Runs cooler with higher top speed. Good for on-road.	Good choice for high speed ovals. Low drag and high speed. Cut silver not recommended.
8 – 11-TURN MODIFIED	Low-turn modified motors are hard on brushes. This one will last the longest.	Not recommended; wear too fast.	Best choice for racing. High comm and brush wear. Replace often.	Not recommended.	Runs cooler with higher top speed. Good for on-road.	Not recommended. Can't handle the current.
12 – 14-TURN MODIFIED	Standard brush for this motor. Use for longer life and 7-cell or off-road racing.	More power than hard brushes; best on smooth tracks.	Best choice for racing. High comm and brush wear. Replace often.	Not recommended.	Runs cooler with higher top speed. Good for on-road.	Not recommended. Can't handle the current.
15+ TURN MODIFIED	Longest lasting for fun running.	Wear is usually no problem with these motors. More powerful than hard brush.	Very good choice. More power without excessive wear.	Not recommended.	Longer motor life than hard or silver brushes. Longer battery life than silver.	Top choice for high speed ovals. Low drag and high top speed. Cut silver not recommended.
10 – 15-TURN 4-CELL	Standard brush for this motor.	Acceptable for 4-cell racing, but cut brush is better.	Good brush, but cut-down silver is even better.	Not recommended.	Not recommended.	Good 4-cell brush. Lower drag. Cut silver is fastest.
DRAGS, TRUCK PULLS	Drag and pull motors see high amps. This brush can handle it best.	Not recommended.	Most powerful brush, replace often. Over 7 cells are hard on these.	Not recommended for high current, high torque applications.	Not recommended. Can't handle the current.	Not recommended. Can't handle the current.
BOATS, HELIS, PLANES	Good brush for long life and low maintenance.	Not recommended.	More power, but too much maintenance for these applications.	Not recommended for high power, high torque applications.	Runs cooler and lasts longer in boats.	Not recommended. Can't handle the current.

Modified motors have adjustable timing, so avoid timed brushes on these motors. When choosing springs, use stiffer springs when the brush compound is soft (e.g., soft copper or silver compounds), when the motor is subject to jolting or vibration (e.g., off-road), or when the course demands high acceleration rates (e.g., on-road courses). Brushes and springs are relatively inexpensive, so keep several on hand and experiment to find what's best for you.

data, the dyno will be a great help in setting up other motors to perform as well as the best one. When you've collected enough dyno and track data, the dyno can help you to choose gears, brushes, etc.

MAINTAINING PERFORMANCE

Even if you're just a weekend driver, you should take good care of your equipment. Motors require more care than any other part of your rig (batteries are a close second). Your motor needs regular cleaning, brushes have to be replaced, and bushings need oil. Modified motors may also need to have their comms trued and bearings replaced from time to time. To perform routine maintenance on your motor, you need a can of motor spray, lightweight oil and a comm stick (a rubberized abrasive stick that has a square end for cleaning the comm and a round end for cleaning brushes).

If you race, you should work on your motor after every heat. If you just drive occasionally, clean your motor after every three or four battery packs. You can't do a good job if you try to clean your motor while it's in the car, so take it out. Remove the brush springs, and pull out the brushes. Be sure to note their orientation; you might want to scratch a mark on the top of each brush. Check the comm and brushes for wear or burned areas.

Wear includes scratches and pits. A brush is worn out when it's noticeably shorter than a new one. It's burned when the comm or brush has been overheated and has turned blue or purple. Throw away burned brushes and their springs; they should not be reused.

Spray short blasts of motor cleaner into the brush hoods and bushings. Continue to spray until the liquid runs out clear. To clean the comm, insert the square end of the comm stick into one of the

REBUILDING YOUR MODIFIED MOTOR

by Doug Mertes

Modified motors have several advantages over stock-class motors. Not only do they produce more power and rpm, but they can also regularly be rebuilt to a like-new condition. Doing the job right can save you time and money and help you to win more races! Follow along as I show you how to keep your motor running stronger, longer.

1 First, remove the motor from your car or truck, and use a stiff paintbrush or workshop rag to clean the outside of the can. Then, using a scribe or a hobby knife (see photo), mark the endbell and the can so that you'll be able to maintain the proper timing when you reassemble it. Don't use a label or a marker, because the ink may come off when you clean the motor can later on. It's also a good idea to mark the can on the "positive" side of the endbell so that you'll be able to maintain the polarity of the motor when you reassemble it.

2 Now remove the brush-hood springs and brushes. Discard the brushes, but keep the springs. Loosen the two small screws that hold the capacitor hooks to the endbell (see photo), and rotate the endbell on the can until it starts to come away from the motor can. Pull the endbell off very slowly and carefully, because you need to make sure that the small washers on the armature shaft don't jump out and hide under the workbench where you won't be able to find them.

3 Disassemble the motor by pulling the armature out of the can. Keep track of the number and type of small washers on each end of the armature shaft (see photo). Each end usually has at least one washer. Inspect the commutator for cuts and burns and the windings for nicks and loose wires. You'll probably be able to freshen up the armature by having the commutator surface cut on a comm lathe. You could buy a lathe, but they're kind of expensive ($340, including a diamond-tip bit), and they probably aren't necessary unless you do a lot of

modified racing. If you don't know someone with a lathe, any hobby shop will do the job for a small fee. When you get the armature back, drag the blade of a hobby knife through the gaps between the commutator contacts to remove any remaining copper dust or scraps (see photo).

4 Flush out the inside of the motor can, the endbell and the bearings with a good-quality motor cleaner (see photo). Now you're ready to put your motor back together. Begin by replacing the motor washers that you took off at each end of the armature. Place the armature in the can, and put the endbell on, rotating it until you line up the marks you made on the can and endbell earlier.

5 Put a drop of oil on each motor bearing, and spin the armature. A short length of relatively narrow rubber fuel tubing makes it easier to grasp the shaft (see photo). The armature should spin easily, and there should be *a little* end play when you pull and push the shaft. If the shaft is too tight, open the motor, remove one small washer from the shaft, and try it again. If the shaft is too loose, spin the armature and let it come to a dead stop. Grasp the shaft and pull. If there's no play, then push. By using this method, you'll be able to judge which end of the shaft needs another spacer.

6 Finish by replacing the brushes and breaking them in for a few minutes at a low voltage. If you aren't sure about the springs you removed, test them for tension on a Class Recreational Products* Spring Thing, which is a handy item to have in your toolbox. I usually test spring tension when I first get a new motor, and then, when it's time for a rebuild, I can refer to my previous readings.

brush hoods, press it lightly against the comm, and turn the motor by hand. Put a pinion on the output shaft to make it easier to turn.

When the comm is clean, spin the motor and spray a little more motor spray onto the comm to wash away any abrasive particles. Next, use the round end to clean the brushes. I prefer to hold the brush in one hand and rotate the stick with the other hand. Others like to move the stick back and forth across the brush. Whichever you do, be careful not to distort the curved face of the brush.

The comm stick will quickly become clogged with metal particles and will stop cleaning. Spray it with a little motor spray, and rub it with a cloth (not your pants leg!). After that, it will work like new. When the brushes are clean, use the flat side of the comm stick or a small file to chamfer their edges to reduce the chance of their being chipped when you run the motor **(see Figure 8)**. Add a comm drop to each brush (if you like), and reinstall them in the same way as you took them off the motor.

If you have a modified motor or a stock motor that can be disassembled, you should disassemble it occasionally to:

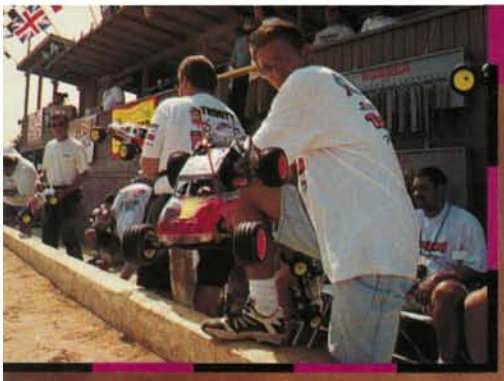
- give it a more thorough cleaning;
- inspect the bearings;
- have the comm trued.

When you take the armature out of the can, be careful to note where the shims are. If you forget where the shims were, assemble the motor without them. Spin the armature, and it will line itself up with the magnets. When the armature stops, push the shaft in to see whether there's any play in the comm end of the motor. If there is, open the motor, add one shim to the comm end, and reassemble the motor. Spin the armature and check again for play. Continue this until there's no more play on the comm end, then put the rest of the shims on the other end of the armature.

Another thing you have to watch for when you disassemble a motor is brush-hood alignment. When properly aligned, the brush hoods keep the brushes 180 degrees apart and centered on the commutator. The only way to be certain that they're lined up properly is to use a brush-hood-alignment tool. Any time you loosen the brush-hood screws, you should do a limited break-in to make certain the brushes are properly seated.

When the motor has been cleaned, reassembled and broken in, add one drop of light oil to each bushing. Now put the motor back into your car and go have some fun!

**Addresses are listed alphabetically in the Index of Manufacturers on page 169.* ■



by GEORGE GONZALEZ

NORRCA TRUCK WORLD CUP

AFTER many years of planning and negotiating, the first NORRCA Truck World Cup was held from September 30 to October 2, 1994, at the world-famous Ranch Pit Shop in Pomona, CA. Many of the top NORRCA drivers—126 total—from the U.S., Mexico, Canada and England, were present.

The event featured two classes of racing: Modified Electric Trucks and .12 Gas-Powered Trucks. Six rounds of Qualifiers were scheduled in the electric class and they were followed by triple A-Mains. The gas trucks ran in four 7-minute Qualifiers, and then the winner was

determined by a single 45-minute A-Main. NORRCA plans to hold this event on alternate years; their off-road national championships will serve as Qualifiers.

FRIDAY: MODIFIED ELECTRIC TRUCK QUALIFIERS

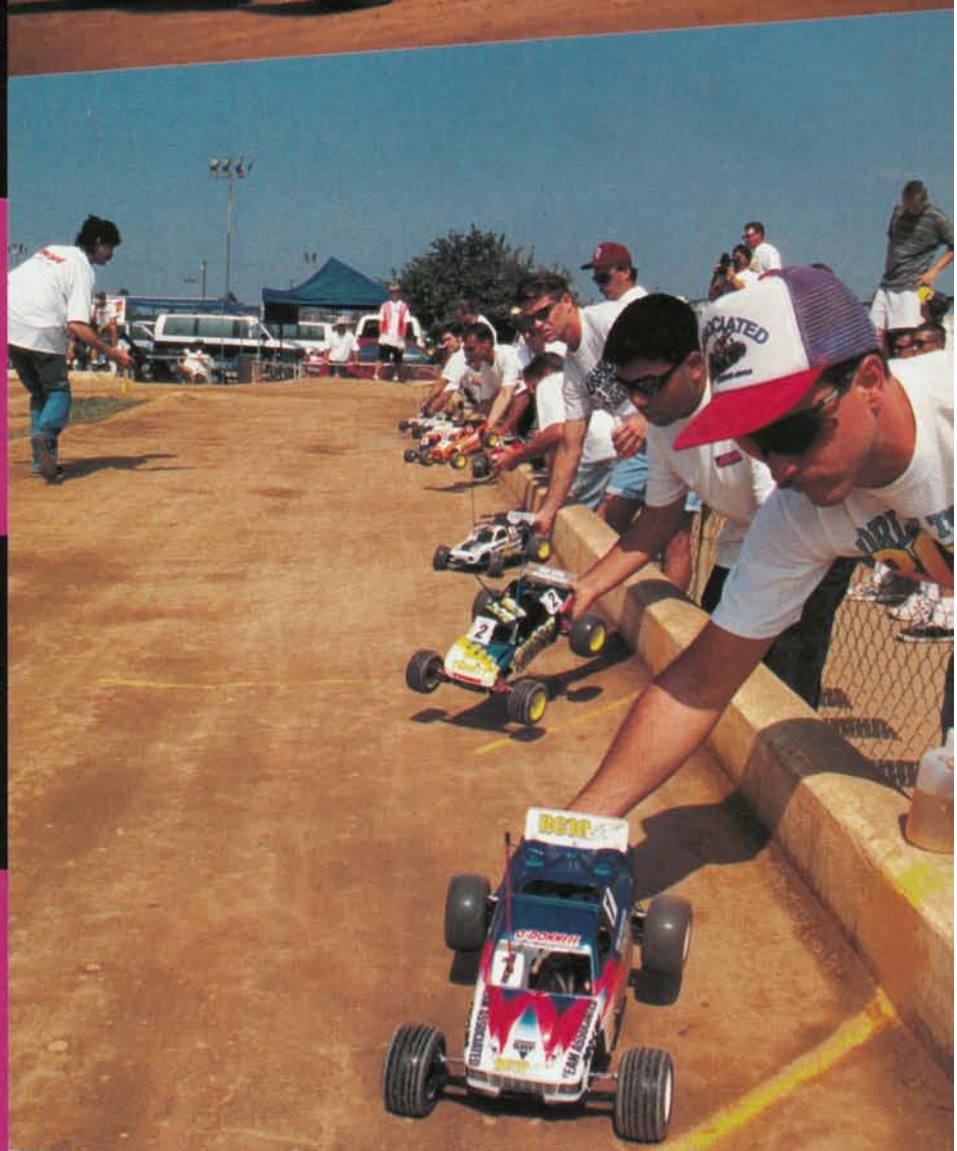
Keith Anderson, an accomplished saxophonist and avid R/C racer, started things off by performing the National Anthem; this jazzy introduction perfectly complemented the event's overall mellow atmosphere. The Spearmint Rhino Club, from Montclair, CA, provided beautiful hostesses who served sodas and food to all the racers and spectators. (Although the hostesses provided great service, their scanty attire did raise a few eyebrows.)

Coming into the competition, Brian Kinwald, a Team Losi factory driver and NORRCA Factory Truck National Champion, was favored, but Team Associated factory driver Mark Pavidis was clearly the man to beat during the Qualifying heats. After battling it out with Brian Kinwald and Jeremy Kortz in six gruelling rounds of Qualifying, Pavidis took the TQ honors with his 10/4:04.87 best time.

SATURDAY: GAS TRUCK QUALIFIERS

As the Qualifying heats began, the sound of 10 screaming 2-stroke engines quickly drew a crowd, and before long, the entire perimeter of the track was surrounded by spectators. When the four Qualifiers were over, Mark Pavidis had once again proved to be untouchable—taking the TQ honors by storm. Brian Kinwald, Scott Hughes

PHOTOS BY GEORGE GONZALEZ



and Jack Johnson also ran exceptionally clean races and managed to finish on the same lap as the leader in all four heats.

Shortly after the Qualifiers finished, two giant barbecues were fired up, and hamburgers and hot dogs were cooked in enormous quantities. Two dollars bought you a food ticket, and all the racers and their friends and family were invited. The racers had a chance to catch up on all the bench racing while they gorged.

Electric Truck A-Main winners.

SUNDAY: A-MAIN ACTION

The Ganesha High School 42-piece marching band made a grand appearance and started things off with the National Anthem. The Modified Electric Truck Mains immediately followed. In the A1 Main, Mark Pavidis's RC10T set a blistering pace, but a pair of Double X-Ts driven by Jeremy Kortz and Brian Kinwald followed dangerously close behind. Pavidis never let up on the throttle, though, and he crossed the line first with an 11/4:16.22. Kortz and Kinwald traded positions throughout the race, but in the end, it was Kortz who crossed the line second with an 11/4:19.86, while Kinwald crossed third with an 11/4:20.41. In the A2 Main, Pavidis couldn't shake off Kinwald, who was all over him the entire way.

With fewer than 10 seconds left in the race, Kinwald managed to get in front of Pavidis, but Pavidis was on a mission and gained the lead right at the finish line.

Pavidis had the honor of winning the first ever NORRCA World Cup Electric Truck Championship, and he left the other drivers to battle it out for the second-place title in the A3 Main. After the dust had cleared, Jeremy Kortz ended up taking the second-place trophy, while Kinwald had to settle for third.

Once again, the entire track was surrounded by spectators as the gas trucks warmed up for the 45-minute A-Main event.

Mark Pavidis—the man to beat.

NORRCA RACE

Right from the start, Mark Pavidis's RC10GT shot out in front and set the pace throughout the race. Brian Kinwald's prototype Nitro Double X-T was tuned and dialed to perfection, and he challenged Pavidis to the very end. After three pit stops and 30 minutes of racing, Pavidis and Kinwald were racing side by side, while Richard Saxton, Tim Bump and Gil Losi Jr. were battling it out for the third-place position. Amazingly enough, both Pavidis and Kinwald were still racing alongside each other on the same lap when the end-of-the-race buzzer

1/10-Scale Electric Truck A-Main

Fin	Qual	Name	Chassis	Motor	Battery	ESC	Radio	Body	Tires
1	1	Mark Pavidis	RC10T	Reedy	Reedy	Novak	Airtronics	Assoc.	Pro-Line
2	3	Jeremy Kortz	XX-T	Peak	Orion	Novak	JR	Losi	Losi
3	2	Brian Kinwald	XX-T	Trinity	Trinity	Novak	Airtronics	Losi	Losi
4	4	Jason Ruona	RC10T	Reedy	Reedy	Novak	Airtronics	Assoc.	Pro-Line
5	7	Greg Hodapp	XX-T	Peak	Orion	Novak	Airtronics	Losi	Losi
6	9	Derek Furutani	RC10T	Reedy	Reedy	Novak	Airtronics	Assoc.	Pro-Line
7	10	Scott Brown	XX-T	Peak	Orion	Novak	JR	Losi	Losi
8	6	Jimmy Babcock	XX-T	Tomahawk	Ballistic	Novak	Airtronics	Losi	Losi
9	5	Mike Weed	XX-T	Peak	Orion	Novak	Airtronics	Losi	Losi
10	8	Scott Roberts	XX-T	Peak	Orion	Novak	JR	Losi	Losi

Kinwald almost took his prototype Nitro Double X-T to victory on its first outing.

1/10-Scale Nitro Truck A-Main

Fin	Qual	Name	Chassis	Engine	Radio	Body	Tires
1	1	Mark Pavidis	RC10GT	CZ-Z	Airtronics	Assoc.	Pro-Line
2	2	Brian Kinwald	Nitro XX-T	CZ	Airtronics	Losi	Losi
3	6	Richard Saxton	RC10GT	CZ-Z	Airtronics	Assoc.	Pro-Line
4	5	Tim Bump	RC10GT	CZ-Z	Airtronics	Assoc.	Pro-Line
5	10	Gil Losi Jr.	Nitro XX-T	CZ	Futaba	Losi	Losi
6	9	Derek Furutani	RC10GT	CZ-Z	Airtronics	Assoc.	Pro-Line
7	7	Jon Anderson	Nitro XX-T	CZ	Futaba	Losi	Losi
8	8	Jason Ruona	RC10GT	CZ-Z	Airtronics	Assoc.	Pro-Line
9	3	Scott Hughes	RC10GT	CZ-Z	Airtronics	Assoc.	Pro-Line
10	4	Jack Johnson	Nitro XX-T	CZ-Z	JR	Losi	Losi

Assoc.—Associated

sounded. Kinwald had only seconds to make his move, but Pavidis never gave him a chance. Mark Pavidis crossed the line first with a 104/45:04.44, Brian Kinwald crossed second with a 104/45:06.23 and Richard Saxton crossed third with a 100/45:12.97. (Talk about a close race!)

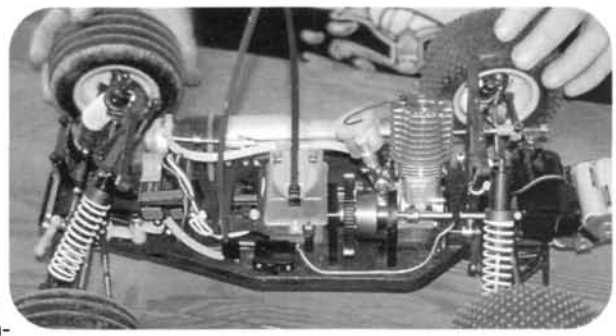
FINAL THOUGHTS

The staff at the Ranch Pit Shop did an outstanding job (as usual) of hosting the event, and the folks at NORRCA should be commended for running an extremely smooth race. I congratulate Mark Pavidis and Team Associated, as well as all the other drivers, for their triumphs.

The NORRCA Truck World Cup was a huge success, and many of the contestants are already making plans to attend the next event. ■

Nitro Double X-T

Many of the Losi drivers were testing highly experimental, nitro-powered Double X-T prototypes (unofficially called the Nitro "Double X-T"). As you have probably guessed, the prototype is based on the new Double X-T electric racing truck, and it has many of the same features. The prototype's most unusual feature is probably the in-line mounted engine. According to Gil Losi Jr., the in-line design distributes the weight more effectively and allows the engine to be mounted lower on the chassis, which lowers the truck's center of gravity.



The prototype shown here incorporates most of the original Double X-T's chassis and suspension components. It also retains the modular design, which is a major benefit around clean-up time. The Nitro Double X-T uses an all-new transmission and a diff that's designed to mate with the in-line engine, though exact details of what's inside the tranny are not available to us at this time. In fact, whether or not this truck will ever be available is also unknown, and the Losi guys were extremely hush-hush on the subject.

All I can tell you is that the trucks looked really hot and seemed to be extremely fast and stable on the track. Brian Kinwald was only 2 seconds away from taking the prototype to a World Cup victory on its first outing—not bad for a prototype.

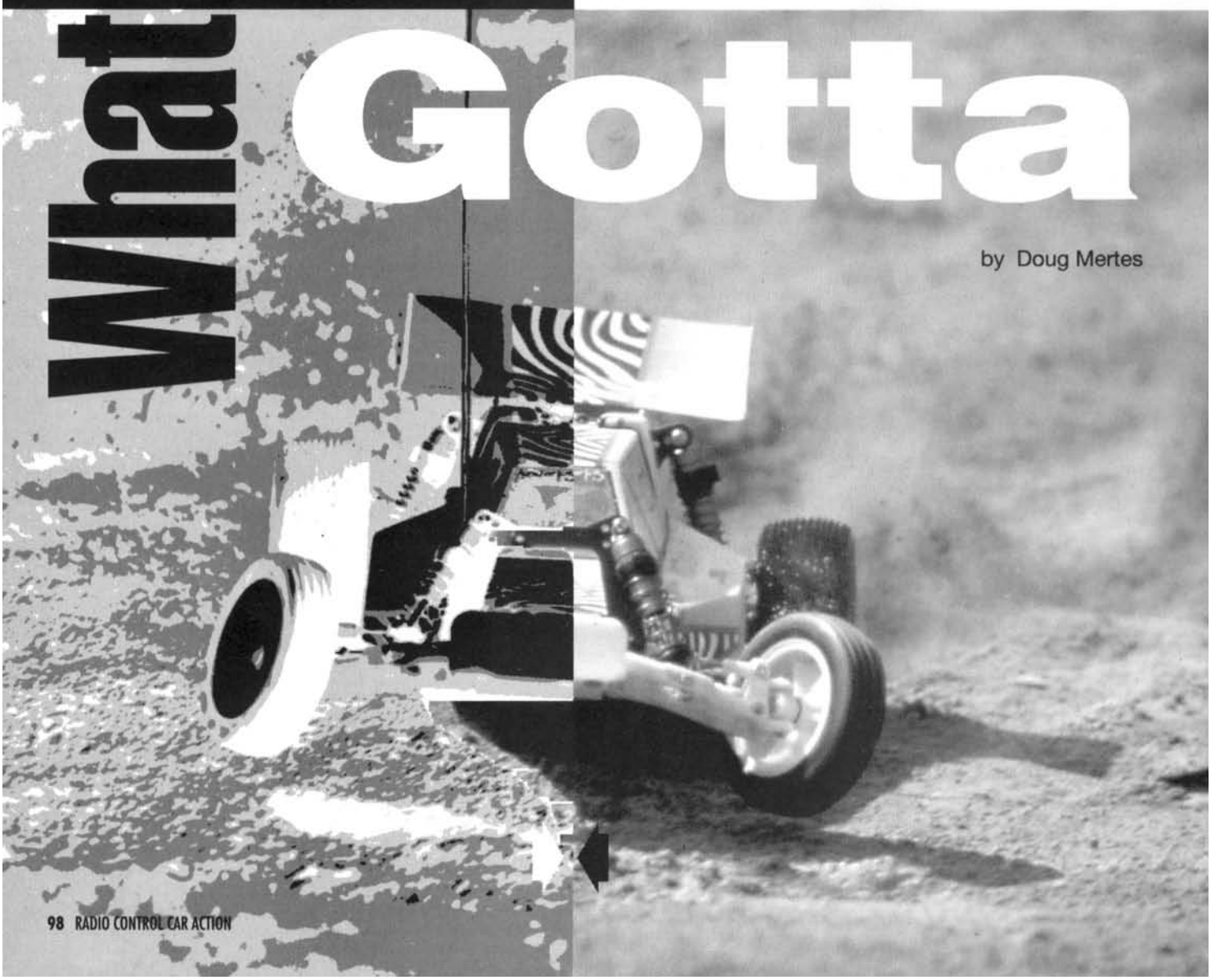
A guide to modifying off-road what, when and how.

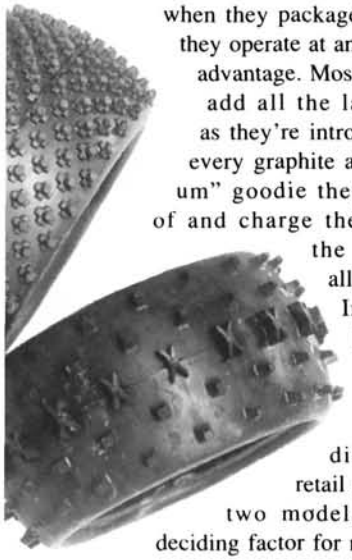
Whatcha Gotta your buggy:

IT HAS FINALLY ARRIVED!

The off-road car that you've been reading about, hearing about, talking about and drooling over at the local off-road gathering place has finally shown up at your door. You're sure that it's everything you've ever wanted in an off-road R/C screamer and more—or is it?

by Doug Mertes





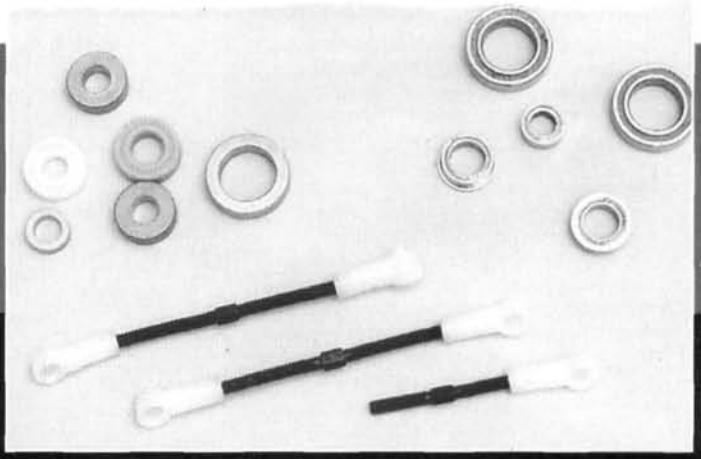
Manufacturers do a pretty good job when they package new kits, but they operate at an economic disadvantage. Most would love to add all the latest hop-ups as they're introduced, include every graphite and "unobtainium" goodie they could think of and charge their customers the true cost of all those options. In reality, they have to market their kits at competitive prices. A $20 difference in retail prices between two models can be the deciding factor for many, so factories have to maintain a delicate balance between performance and price.

With the understanding that what the box on your workbench contains is, generally speaking, the best basic kit ever offered in the history of off-road R/C racing, I'd like to offer some general guidelines and time frames for your modification schedule. Don't fool yourself; you will be buying go-fast, after-market parts for your new machine. If you make informed decisions and plan your purchases, your car will become faster and more reliable every week!

Much of the information in this article was supplied by factory drivers themselves. These are the suggestions that racers and drivers would make to their friends, if asked, and you just don't get any better advice than that! It's tough for factory drivers to think like regular consumers, though, because they don't have to pay the going price for what they use. So some of their suggestions have been tempered by the reality of what things cost versus what they deliver to the average racer.

Everyone agrees that the first place to spend money is at the track. You'll get more out of a couple of days of track practice time than you will from a new motor. Before you can start to go fast, you have to learn to drive well. That may seem simple, but you really have to work at learning how to place your car exactly where you want it on the track before you can ever hope to be competitive. Once you're accustomed to your car and you're comfortable with your driving skills, you can take a look at what to buy to make your driving even more consistent.

have?



PHOTOS BY DOUG MERTES

Step 1
Investing $50 to $100

Let's assume that you've bought a basic kit, like a Losi* Junior 2, a Kyosho* Outrage, a Schumacher* Club car, a Traxxas* Rad 2, or an Associated* RC10 Championship Edition. These are great cars, but when you have some extra cash, you can make them work a lot better. First, you really need to get a set of ball bearings. Most manufacturers, as well as after-market firms like Boca Bearing* and Dynamite*, offer a full set of bearings in a single package. You can also purchase individual bearings at hobby stores that stock R/C parts. Check your assembly manual for a list of bearings, so you know which ones you'll need. You could start by purchasing bearings only for the transmission or the wheels, and you could buy the rest when you have the bucks.

Bearings reduce friction in the transmission, wheels and axles of an off-road buggy. They also increase run time and speed, and they maintain the suspension adjustments that you worked so hard to figure out. Good bushings, like those from Losi, Tamiya* and Associated, do a pretty good job of supporting moving parts. Unfortunately, by their very nature, they eventually wear out of round. Toe-in and caster and camber settings no longer remain constant, and things can get pretty sloppy.

Properly maintained bearings, on the other hand, will last a long time and help keep those important suspension adjustments in tune. Slop is minimized, and toe-in and camber adjustments don't change. Speaking of suspension settings, the next parts you should buy are quality ball links and turnbuckles.

Many kits come with fixed upper links for the front and rear suspension and wire Z-bend links for the steering linkage. Some come with ball links on steel 4-40 threaded rods. You have to pop off the ball ends to make adjustments but, pretty soon, the ball ends will pop off all by themselves when you hit a bump or a barrier. Replace them with decent ball links or ball ends (RPM* and Rocket City* are good after-market suppliers) and turnbuckles, and you'll discover a whole new world of reliability. Now, when you give the wall a hard whack, you'll be able to motor on with confidence.

You don't need the expensive titanium turnbuckles yet. The plain old steel ones from Associated or Du-Bro* will work just fine for now. When you step up to the big leagues, however, you might want to invest in some titanium. Tecnacraft* and Lunsford* make complete titanium sets for many models. Associated makes a cup and steel turnbuckle set for $16 that includes everything you'll need to outfit virtually any off-road buggy. If you have the money to spend, titanium is much lighter and stronger than steel.

You could also buy an extra, inexpensive battery pack or two. You don't need the fancy-schmancy matched packs for practice, and $20 or so should buy you what you want. You'll get more practice time if you go to the track or the field with a couple of charged packs, than if you have to stop and recharge the same pack all afternoon. Plus, your batteries will last a lot longer if you let them cool down between runs.

Modifying your off-road buggy

Step 2
Investing $100 to $200

Before you can strap in major horsepower, you need to harness it. Make sure it's going to get to the ground and not disappear in wheelspin. The best way to do this is to buy an assortment of shock fluids, pistons, springs and tires, and learn how to use them.

Pick up some shock oil in 10WT increments, from 10 to 50WT. Associated, Losi, Trinity* and many other companies do a great job of supplying the off-road market with silicone shock fluid that keeps its viscosity regardless of temperature. With the right shock oil, pistons and springs, you can deal with just about any terrain that track designers throw your way. Experiment with different piston-hole sizes, oil viscosities and shock springs (and refer to Jack Johnson's excellent articles in the November '94 issue) to understand what they can do for your buggy's handling.

Different tires allow you to cope with changing track conditions. Purchase front and rear tires in three- or four-tread designs, e.g., pins, ribs and spikes. If you need advice, go to your local track on race day and see what cars people are running and what seems to work. For the rear, I recommend sets of pin spikes, medium spikes or blocks, and a pair of larger spikes for loose, fluffy tracks. Up front, try some small spikes, ribs, wide ribs and a rib-and-spike combo. You'll find that each has a different feel, e.g., more bite, more steering, or easier to slide. Some will fit your driving style better than others, but you won't know until you try. If you're on a limited budget, see if you can borrow a set from a pit buddy. One or two runs won't really wear out a set of tires, and it might help you to decide what you really need.

Step 3
Investing $200 to $300

Now that you have the equipment and experience to properly adjust your off-road buggy for every possible surface variation, you can start to look at the go-fast stuff. High-frequency, electronic speed controls will make your motors last longer, and because of advanced regenerative technology, your runs will last longer, too. Matched battery packs will produce more punch off the line, longer run times and, when they're properly discharged and maintained, longer life. High-end FM and PCM radios provide solid, locked-in control and more adjustments than you ever thought existed. Hot stock and modified motors will introduce you to the possibility of—dare I say it—too much power!

If you're into the visual side of radio control, now may also be the time to start looking at custom paint jobs. Most of us can figure out how to put a car together, and with some reading, research and practice, we can manage to adjust and drive it pretty well. Not everybody has the kind of creative genius that makes a car a stunning visual experience, but there are a number of after-market paint specialists who can turn your clear Lexan into R/C nirvana. Be prepared to pay, however: a custom spray job can easily cost you $100 or more.

One final piece of advice: the ultimate R/C accessory is your own talent. The really good drivers can be competitive with any kind of equipment. If you take a close look at national-level winning cars, you'll see that many of them are carefully assembled and adjusted using all stock components.

Do you want a truly humbling experience? If you get the opportunity, ask a factory hot shot to drive your car for a couple of minutes. With all of the time you're spending at the track, you'll probably meet a couple of locally sponsored racers. Most factory drivers are on the up and up, so maybe they'll help you set up your buggy the right way. Good luck and have fun driving!

**Addresses are listed alphabetically in the Index of Manufacturers on page 169.* ■

Talking with the best off-road racer

by John Howell

I FIRST MET Brian Kinwald at the '92 ROAR Off-Road Nats in Dallas, TX. One of my assignments while I was at the race was to conduct a mini-interview with Brian as part of our race coverage. When I caught up with him, my first impression was, "Now here's a really quiet, somewhat shy dude, who digs R/C cars." As soon as I saw him hit the track, though, my impression quickly changed. His personality split, and he was a madman out there. You could tell he didn't want to settle for second place. He made driving an R/C car *that* fast look easy, while everyone else was struggling. Brian went on to win the Modified 2WD national title at that event, and he also made it into the 4WD A-Main.

Since then, I've had many opportunities to see Brian in action. I've watched him come through the ranks to win not only a ton of other national titles, but also to claim the title of off-road world champion. In my opinion (and those of many others), he's the best off-road driver in the world at this time. Brian is one of the most dedicated racers in the sport, and it shows; he excels at any type of off-road racing, be it electric or gas.

There have recently been a lot of changes in Brian's racing career; most noticeable is the major change of sponsors—from Team Associated/Reedy to Team Trinity/Team Losi. No matter where he goes or what he races, he's sure to be one of the fastest, if not *the* fastest, on the track. Frank Masi and I ran into Brian at the RCHTA show in Chicago, and the three of us sat down and talked about his racing career—how he started and where he's headed.

Doog: How did you get into R/C car racing?

Kinwald: Basically, one of my friend's older brothers had an RC10, and I just played around with it. He found out about a local track nearby and he started racing, and I went to watch. This was around '87. I watched him for a while, and then I got into it and started racing.

Frank: When you saw your first race, what was it about racing that really got you turned on to it and made you want to do it?

Kinwald: Probably the monster trucks. The first JG-type, conversion-type trucks looked pretty cool to me, and we all wanted to get them. That's mainly what got me into it—just messin' around with that type of thing. Then I actually found out I could race in an organized fashion. I used to race BMX, so I already understood the basics of racing.

Doog: When you first started racing, what equipment were you using?

Kinwald: The first car I had was a Losi/JG conversion monster truck.

Frank: How long did it take, from when you started, to find that you were a really good racer?

Kinwald: When I went through about four months of just breaking...I couldn't even get through a 4-minute race; then I started watching people, and I noticed that everyone was crashing. I figured that even if I go slow, as long as I don't crash, I'll most likely end up winning the race.

Doog: How long was it before you started winning consistently?

Kinwald: It probably took me a year. After a year, a year and a half, you could say I was competitive.

Frank: Was there ever a point where you said to yourself, " I have to look for a sponsor," or did a sponsor seek you out?

Kinwald: I never really went looking for a sponsor. It was one of my goals, but at the time, the teams were pretty small and there weren't a lot of sponsored drivers. So I didn't really think I had a shot at getting sponsored; but apparently I did. My first sponsor was Peak Performance; that was around two years into my racing career.

Doog: What propelled you into the spotlight, or at what time were you first noticed?

Kinwald: The ROAR Nationals at the Hobby Haven raceway in 1990. Mike Reedy kind of knew that I wanted to run his motors and to be sponsored by Associated. I asked him what it took to be sponsored by them, and he told me that you have to make the Main at big races. I qualified fifth at the Nationals, so that kind of got me in the door at Associated.

Frank: With the way races are run right now, do you feel that you need one major sponsor to even make the show? What chances are there for the privateer?

Doog: Like when Masami won the 4WD Worlds without a sponsor. Can that be done today?

Kinwald: I think so. In on-road I don't, but in off-road, I think it's possible. I know people who aren't sponsored by anybody, and they have enough talent to go fast, if they take it seriously.

Frank: What do you think about a separate class for factory drivers?

INTERVIEW:

BRIAN KI

n the world

Do we need it at this point?

Kinwald: I think that would be good. I'm not really sure if we need it. I think most of the sponsored guys will tell you we don't need it; but most of the unsponsored guys will say we do, mainly because we have access to prototype parts or tires that they don't have access to. Also, I've found that the guys who want the separate classes are usually the guys who hang out with factory drivers. It's the guys who don't hang out with the factory drivers who like to race against us most of the time. Usually, they want to see how they could do.

Doog: I'm curious about when you walk onto the drivers' stand right before a big A-Main at a national event; what goes through your mind right before the buzzer goes off? How do focus on your race?

Kinwald: I mainly try to be as calm as possible and not really worry about it. Usually, I'll think about where I am on the grid, or mainly about the start; I think about the start the most.

Frank: Considering all the people you've raced against, does anyone stick out in

I couldn't even get through a 4-minute race; then I started watching people, and I noticed that everyone was crashing. I figured that even if I go slow, as long as I don't crash, I'll most likely end up winning the race.

NWALD

your mind as being a calm, cool racer—someone you can't psyche-out on the drivers' stand?

Kinwald: A few people won't get psyched-out, just because they've been doing this for a long time and they're calm. Jeremy Kortz is probably the only one you can't rattle in any way. He basically doesn't care about racing at all, so that makes him fast—in my opinion.

Doog: Who's your toughest competitor at this point?

Kinwald: Mark Pavidis.

Frank: You've been around for a while now; what do you think has changed the most in racing to make it faster?

Kinwald: Pretty much everything. When I started racing, the cars weren't very advanced; as for tires, no one really thought about using softer compounds; there were different patterns, but that was it.

Doog: Yeah, everyone took two sets of tires to the track and that was it.

Kinwald: Exactly. I would buy a new set of tires every week; and I thought that was a bit much.

Frank: Now it's one run on a new set.

Kinwald: Yeah. Mainly the equipment has changed. When I first started, I didn't go to too many really big races, so it's hard to say what it was like back then; but I'd say the equipment is definitely better.

Doog: Give us some of your impressions on running Losi and Trinity products.

Kinwald: I ran for Associated for four and a half, five years, and I basically had the same car from the time I started racing. I saw all the people around me switching teams and going back and forth, and I had never changed a sponsor. I'd been runnin' the same car the whole time, and I'd just won the Worlds and every big race that I could have, and I just wanted to change everything; to see if I could do it with another car and different equipment.

Doog: So basically, it was along the lines of, " Can I still be as fast with a different setup?"

Kinwald: I don't think I could duplicate how I've done in the past few years; it would be pretty hard to do it again. But I knew that Losi's car and Trinity's motors and batteries were, at the time, better than what I was running. I didn't have any doubts that I might switch and be slower; I knew that I'd be faster. But there's still a lot of luck involved in racing, so I couldn't say that I'd win as much, but I knew I would be faster if I switched.

Doog: Thinking back to the IFMAR World Championships in England, I remember watching you dominate the race when the 2WD Mains came around; did you have a game plan going into the event?

Kinwald: Basically, Joel Johnson and Scott Brown went out every round and set a new TQ; they were fast every time they went out on the track. The Associated team was pretty much struggling because we didn't really know what to do to our cars on a rough track like that to be as fast. So when it came around to the last Qualifier, I put a Hydra Drive in my car and it instantly went faster. But that was the last round; I was still eighth qualifier, and I was going into the Main with my car different from how I had run it, so I didn't really know how it would work. Then, when I went out in the practice Main, I found I could go as fast as, or even faster than, everyone on the track, without much difficulty; so I knew if I could get a good start, I had a good chance at winning the race.

Doog: At the start of the third A-Main, you holeshot everyone off the line, took off, and made them all look as if they were in reverse by the end of the first lap. It was a pretty amazing drive. Would you count that as your biggest accomplishment in your racing career thus far?

Kinwald: I'd have to say that it is.

Frank: What could you possibly do for an encore? What's next?

Kinwald: I'd like to keep racing and go to more world championship events. Also, another reason I wanted to run for Trinity was their on-road reputation. I feel that I could go out and be competitive in on-road. I don't know how serious I'm gonna take it, but I'm gonna start learning all I can, and eventually, I'll start going to some big on-road events.

Doog: Are you going to try out superspeedway?

Kinwald: I think so.

Frank: It seems that you have started to develop your own product line with Trinity; what can we expect to see in the future?

Kinwald: Well, right now, we have the Kinwald modified-motor lineup, and we have some new heavy-duty pinions. We have a lot of things planned for the future that are hush-hush right now.

Doog: What's the toughest racing situation you've ever been in?

Kinwald: Two are equal. The last Main of this year's 2WD NORRCA Nationals is one. I was TQ and ended up second in the first of three Mains—fifth in the second Main. The only way I could win the race was to win the last Main, but I would have to have somebody else besides Mark Pavidis or Matt Francis finish second. I had to win and make sure that someone else got second besides one of them. I was following Mark most of the race, and we got together, and he flipped. Someone else, I think it was Carlos Gonzales, got into second and ended up staying there, not knowing that if he let Mark by, Mark would have won. So I ended up winning by a point.

The other race was this last ROAR Truck Nats at So. Cal.; I was second Qualifier in the Modified class. In the first Main I finished second, in the second Main I finished second, and I had to win the last Main to win the race. I followed Pavidis for almost 4 minutes—until two laps to go—and he barely got loose. I just got by him, and we finished one and two that way. It was pretty intense.

Frank: I notice that you do all your own work on your car at races; how important do you feel it is for racers to understand their equipment and do all their own work and setups?

Kinwald: I think it's really important. Masami, for example, doesn't work on any of his cars—his dad does everything for him. He knows how to do it; he just kind of takes the approach that it's easier to race when you're not worrying about your car. I think that's true, too; it's a lot easier. But, when you go up on the drivers' stand, you want to know how your car's gonna work, and if you don't work on it, you're not sure how your car will react.

Doog: How do you practice?

Kinwald: I usually practice at club races. I don't actually run pack after pack at the track to practice driving that much. You learn more from true racing situations.

Doog: What advice would you give to a racer who wants to dedicate more time to and get a little more serious about racing?

Kinwald: First, I'd tell him to practice; go out there for 4 minutes and don't crash. Get comfortable enough to where you're in control and you're not flying off the track everywhere. If you can go out there and take any line you want and you're comfortable and you're not crashing, then start working on making the car easier to drive with different setups.

Doog: What do you do in your spare time when you're not racing?

Kinwald: I pretty much work on my car [laughs].

Doog: Because the Double-XT is so new, we really haven't received much feedback on it from any racers. Give us your expert opinion of Losi's new truck.

Kinwald: I think it handles great. From the first time I threw it on the track, I was laughing at how well it worked, without even doing anything to it. It's basically easier to drive than any other truck I've ever driven, and I found that my lap times dropped considerably. It handles more consistently.

Frank: What advice do you give to up-and-coming racers?

Kinwald: Don't get discouraged; keep trying. Eventually, one day you'll do really well, and when you do it once, that's a big step.

Thanks, Brian. ■

NEW PRODUCT WATCH

WHEN I WAS NOTIFIED by the editors of *Radio Control Car Action* that I was scheduled to do a product review, I freaked! I've been racing for five years and I've covered a lot of races for the magazine, but I was never before asked to test a product's performance. They assured me that my first assignment would involve minimal assembly with maximum results. They were right! I tested the MIP* CVD.

Eustace Moore of Moore's Ideal Products (MIP) designed the Constant Velocity Drive (CVD) to replace the factory-built outdrive assembly. According to Moore, the CVD offers three improvements over the stock parts: price, reliability and performance.

MIP CVD Better than bones...

CONSTANT VELOCITY DRIVE

MONEY IN THE BANK

Price is a factor, although, at face value, only a minor one. The CVD costs only about 10 percent less than the factory replacement unit, but it will last longer because of its composition and because, unlike its factory counterpart, the CVD can be rebuilt with individual replacement parts—a big plus in the long run! The three main sections of the unit are the axle, the coupling and the bone, which are all made of hardened carbon steel; each part is hardened to a different strength so that it will provide maximum durability in relation to its function.

BY RICK SCHWARTZ

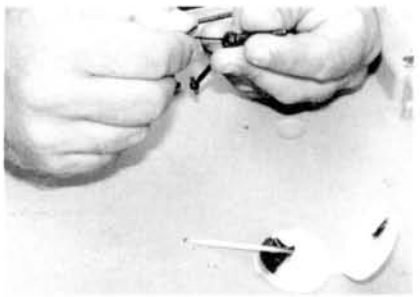
AN EASY FIX

The outdrive assembly on an R/C race vehicle—stock or modified, car or truck—goes through a lot of wear and tear. One of the best attributes of the CVD is that it's totally rebuildable. Not only can you replace worn parts, which are all sold separately, but you can also check for wear when you do regular maintenance. This reduces the chance of a part's failing while it allows you to repair the unit without having to buy the entire assembly. This translates into easy and inexpensive outdrive reliability.

We all felt that the CVD enhanced the performance of our vehicles on the track.

PHOTOS BY WALTER SIDAS AND RICK SCHWARTZ

Once installed, there was a noticeable performance gain.



The CVD unit is totally rebuildable, which allows for easy, routine maintianence

AT THE TRACK

I tested the CVD at my home track in Coral Springs, FL. I recruited three other racers of varied skills to ensure that the test would be unbiased and to determine whether the benefits of the CVD would vary in different vehicles—the Team Losi* Double-X and LX-T and the Associated* RC10 Worlds Car and RC10T. We first tested the ease of assembly. We all agreed that it was simpler and faster to build than the stock units. The parts fit together perfectly in all of the kits, and the instructions were clear and concise.

To begin construction, you spread a thin layer of CVD lube on the coupling and insert it into the axle. You then slide the axle into the bone and secure it with a cross-pin. Finally, you put a setscrew in the coupling. When the CVD has been constructed, you put three shims (supplied in the kit) on the axle and install the CVD unit on your vehicle, just as you'd install a stock unit. The only thing we would have preferred is metal shims instead of nylon ones.

We first tested our cars' performances with the stock units and then tested them with the CVD units; this gave us the opportunity to test the differences under almost totally identical track conditions.

AND THE WINNER IS...

We all agreed that the CVD is an improvement on the stock unit. We felt that the CVD provided a tighter fit with less play, less vibration and less backlash (both ends of the CVD turn at the same time, without any delay). Because of this improvement, the power is put down more evenly and the car is less likely to fishtail or to become squirrely when it's accelerating off the line or coming out of a turn. We also agreed that acceleration and response seemed smoother when coming off jumps and going through rough sections of the track.

We all felt that the CVD enhanced the performance of our vehicles on the track, but even more impressive to us is that the CVD may be maintained or rebuilt so easily. We all agreed that the CVD's tight fit, which produced the positive vehicle performance, could be made a permanent asset through easy and inexpensive maintenance.

**Addresses are listed alphabetically in the Index of Manufacturers on page 169.* ■

National Organizations

ROAR

Radio-Operated Auto Racing
Contact: Steve Whitney, Administrator
1056 Red Bud Circle
Rockledge, FL 32955
(407) 631-5857

NORRCA

National Organization for Racing Radio-Controlled Autos
Contact: J.R. Sitman, Adminstrator
1651 W. Foothill Blvd., Suite 292
Upland, CA 91786
(909) 944-5381
(909) 944-2996 fax

NRCTPA

National Radio-Control Truck Pulling Association
Contact: Don Hubert, Administrator
2321 Greenwood Ct.
Champaign, IL 61821
(217) 359-7628

From the track to the parking lot.
This is the R/C action as **you** see it.

by Chris Chianelli

Grassroots RACING

This is YOUR PAGE—YOURS!! It belongs to you: the R/C car enthusiast who loves to race with friends and family; the optimistic racer on a budget who's looking to do some evenly matched CCR (Cost Controlled Racing) racing; the individual in it for the greater fun of it all—the grassroots racer. I promise you one thing: you'll never see a sponsored racer's name on this page unless it's to tell how a local hero kicked his butt. We at *Car Action* want to see what's going on and how you're organizing races at your local track, hobby shop and parking lot. Even if you and your buddies run truck races in your backyard, hold club meetings in the garage and have trained the family dog to turn-marshal, I want to hear about it! Send in the photos!—snapshots, 35mm slides, Polaroids, anything!—we'll take it. Don't forget the trophy girls.

A special sidebar will address upcoming races, and, in a subsequent issue, you'll see the local hot "trigger-fingers" who won those races. Remember: big sponsors are always watching, hoping to find the next world champ at a local track.

To get things rolling, I'll print the phone numbers of hobby dealers, chains and distributors that have already set up CCR programs. If you're a dealer, or just a bunch of fun-lovers in search of a race program, give them a call!

call now!

If you're a dealer or just a bunch of fun-lovers in search of a race program, call now! Here's a few hot-line phone numbers that you can use if you have any questions, or if you'd like to start a program in your area.

Bolink Legend Series
(404) 963-0252

Tamiya R/C Championship Series
(800) TAMIYA-A

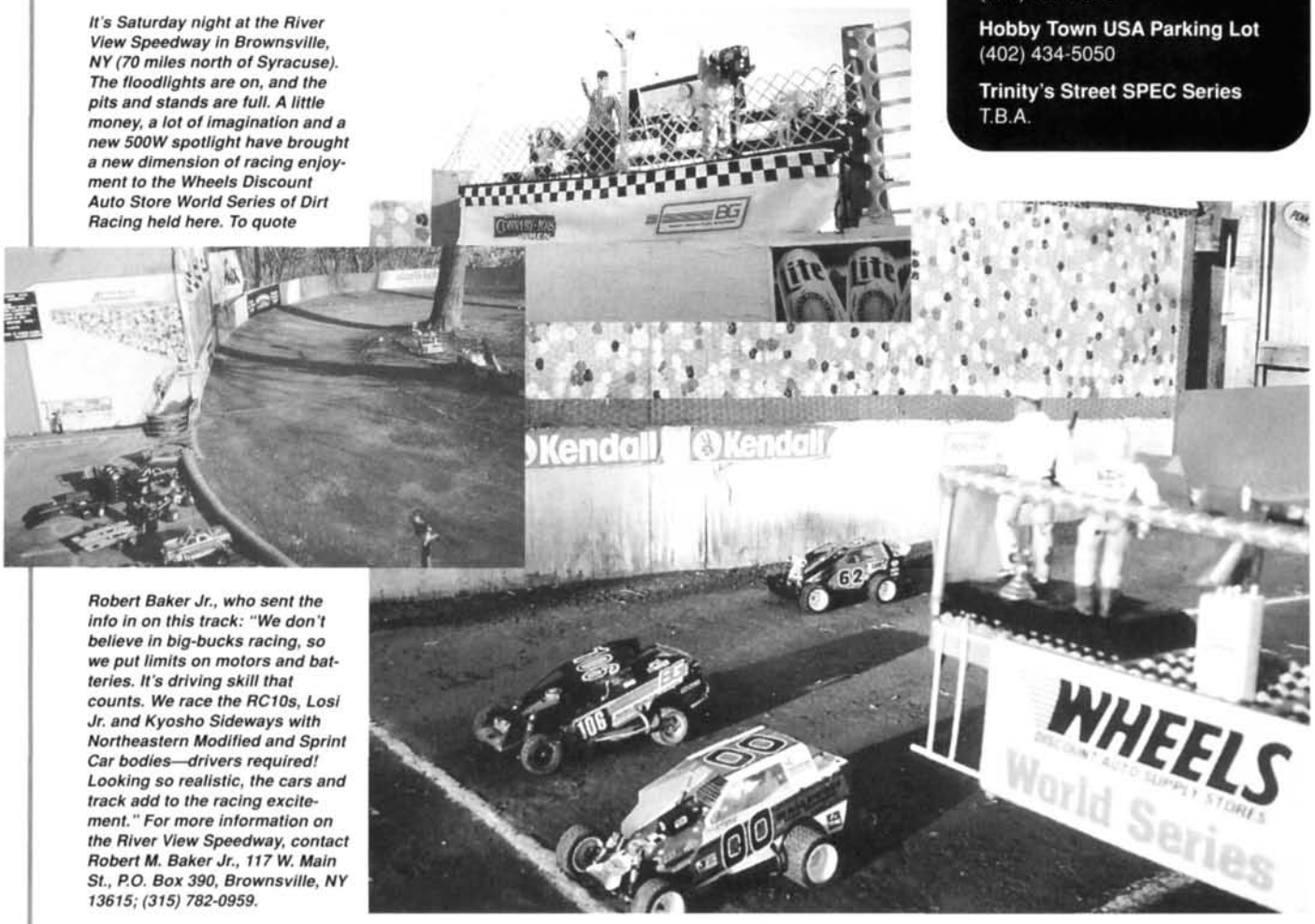
Kyosho R/C Sport Racing
(800) 682-8948, ext. 085F

Hobby Shack Parking Lot
(714) 964-8846

Hobby Town USA Parking Lot
(402) 434-5050

Trinity's Street SPEC Series
T.B.A.

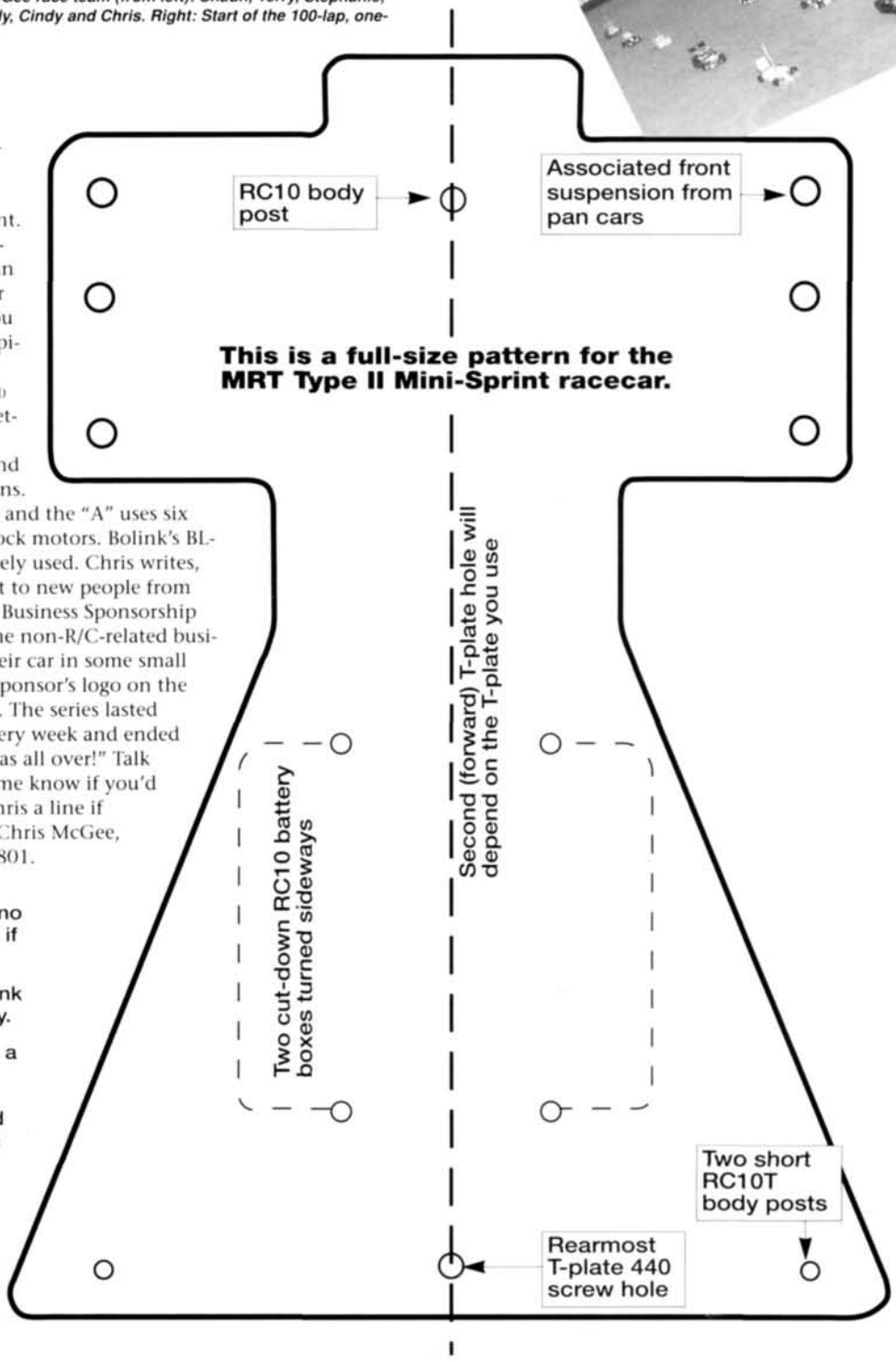
It's Saturday night at the River View Speedway in Brownsville, NY (70 miles north of Syracuse). The floodlights are on, and the pits and stands are full. A little money, a lot of imagination and a new 500W spotlight have brought a new dimension of racing enjoyment to the Wheels Discount Auto Store World Series of Dirt Racing held here. To quote Robert Baker Jr., who sent the info in on this track: "We don't believe in big-bucks racing, so we put limits on motors and batteries. It's driving skill that counts. We race the RC10s, Losi Jr. and Kyosho Sideways with Northeastern Modified and Sprint Car bodies—drivers required! Looking so realistic, the cars and track add to the racing excitement." For more information on the River View Speedway, contact Robert M. Baker Jr., 117 W. Main St., P.O. Box 390, Brownsville, NY 13615; (315) 782-0959.



Above: a variety of bodies are used to make the field more interesting. Chris says, "If there are any other 1/12-scale Sprint bodies out there, please let me know about them." Top right: family racing is alive and well in Kansas. The McGee race team (from left): Shaun, Terry, Stephanie, Dad and Mom. Not in the picture are Randy, Cindy and Chris. Right: Start of the 100-lap, one-battery Enduro race—lots of action.

I thought the McGee family's solution to the rising cost of racing should be passed on to *Car Action* readers. It's the 1/10-Scale Mini Sprint. Designed by Chris McGee, the full-size chassis pattern you see here can be used as a template to make your own chassis out of any material you like. Just get yourself to a photocopier. The full-scale Mini Sprint is so small that this pattern is in true 1/10 scale. Basically, the cars are completed using Parma aluminum or Associated 12L-10SS motor pods and Associated pan-car front suspensions. The Mini Sprint "B" uses four cells and the "A" uses six cells. Both classes use 24-degree stock motors. Bolink's BL-2006 1/12-scale Sprinter body is widely used. Chris writes, "In an effort to introduce our sport to new people from all areas, I came up with the Local Business Sponsorship Series. The drivers went out to some non-R/C-related businesses and got them to sponsor their car in some small way. In return, the driver put the sponsor's logo on the body to advertise for that business. The series lasted four weeks. The leader changed every week and ended up in a tie for first place when it was all over!" Talk about evenly matched racing! Let me know if you'd like more stuff like this, or drop Chris a line if you'd like more info on the rules: Chris McGee, 2105 Belmont Dr., Emporia, KS 66801.

- On a smooth track, no rear shock is needed, if a thin plate is used.
- Chassis fits the Bolink #2006 Sprint-car body.
- Our Type II cars use a T-plate with 5/8 in. between holes, but I have since completed prototypes III through V—the last one uses a 12L plate, 6 cells and works great.



TECH HEAD

by Frank Masi

Gear it right

Proper gearing is a subject that's often overlooked by novice drivers, and it's one that's certainly owed more attention than it's given by many experts. Hours are spent adjusting shocks, springs and static settings, yet most racers choose gearing on a seemingly random basis!

FINDING RATIOS

When selecting gears, the most important information you need is the final drive ratio of your car. A ratio is simply a relationship between two similar things—in this case, the number of times the motor's output shaft revolves in relation to one revolution of the transmission outputs. Think of the final drive ratio as a lever that you might use to lift a heavy object: a higher ratio is like using a longer lever, which, because it would enable you to lift the object more easily, provides the motor with greater leverage against the drive wheels.

Here's how to determine final drive ratios:

1. Divide the number of teeth on the spur gear by the number of teeth on the pinion gear.

Example: an 86-tooth spur gear divided by a 25-tooth pinion gear equals 3.44. If the car has direct drive, i.e., you have an on-road, pan-type car, you've finished.

2. If your car has a reduction-type transmission, you must multiply the pinion/spur ratio by the internal ratio of the transmission.

Example: it's known that the Losi Double-X transmission has an internal ratio of 2.19:1. Therefore, using the same spur and pinion sizes as above, multiply 3.44 by 2.19 to get a final drive ratio of 7.53:1.

If you don't know the transmission's internal ratio, here's how to find it:

- For three-gear transmissions, divide the number of teeth on the bottom (outdrive) gear by the number of teeth on the top (input) gear.

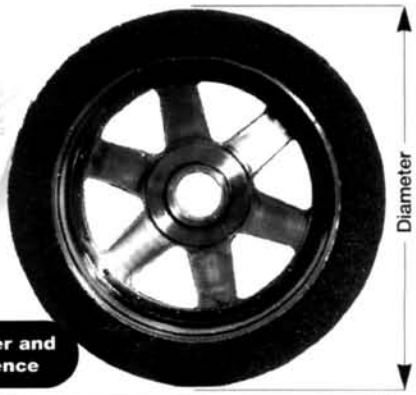
Example: a 46-tooth bottom gear divided by a 21-tooth top gear equals a ratio of 2.19:1. Disregard the idler or counter- (middle) gear, because its size has no effect on the ratio of the tranny. I found this concept confusing until I realized that, regardless of the counter-gear's size, the bottom gear moves by the same number of teeth as the top gear.

- For belt-drive transmissions, such as those found in 4WD cars, divide the number of teeth on the diff pulley by the number of teeth on the input shaft pulley.

GOING FROM BUGGY TO TRUCK

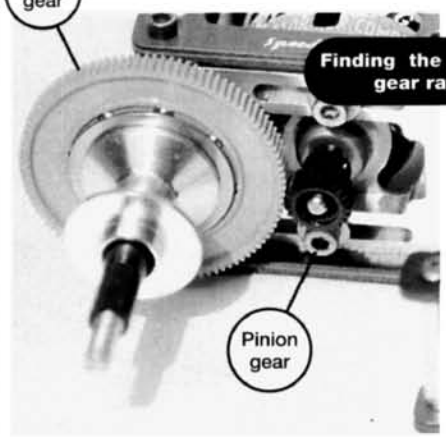
Now that you know your car's final drive ratio, there's one more important bit of information that should be taken into account—tire size. With a typical 1/10-scale on-road car, a change in the tire's diameter of 0.05 inch equals one tooth on a 64-pitch pinion gear, and

Some motor manufacturers provide gear charts and recommended final drive ratios for their motors. This information is invaluable when you're gearing your car or truck.



Tire diameter and circumference

Circumference = πD (3.14 x diameter)



Finding the primary gear ratio

Spur ÷ pinion gear = primary gear ratio

Typical three-gear transmission (off-road type)

To find the transmission's internal ratio, divide the number of teeth on the bottom gear by the number of teeth on the top gear.

with off-road, switching a motor from a buggy to a truck requires a major gearing change because of the truck's much larger tires.

When swapping a motor from buggy to truck, you'll need to approximate the proper gear ratio.

1. Do this by following the above steps to find your buggy's final drive ratio (7.53 in the example).

2. Next, determine the circumference of both the buggy tires and the truck's tires. The circumference is the total distance around the outside of the tire, and it's also the distance that the tire will travel in one complete revolution. Use a flexible measuring tape to do this, or calculate the circumference by multiplying the tire's diameter, i.e., its height, by pi (approximately 3.14).

Example: assuming diameters of 3.5 inches for the buggy tire and 4 inches for the truck, we get approximate circumferences of 11 inches and 12.5 inches, respectively (3.5 x 3.14 = 11 and 4 x 3.14 = 12.5). Note: the tires' diameters can be used, but finding the circumference gives more accurate results.

3. Divide the circumference of the truck tire by that of the buggy tire (12.5 ÷ 11 = 1.14).

4. Multiply the result of step 3 (1.14) by the final drive ratio (7.53). The result is 8.58.

5. Divide the result of step 4 by the internal ratio of the truck's transmission. In this example, we're using the same 2.19 ratio for both buggy and truck, but because we're working the equation "backwards," you could easily substitute a different ratio.

8.58 ÷ 2.19 = 3.9.

6. We now know that to use our buggy motor in our truck, the truck's pinion/spur ratio must be 3.9. If you use the same, 86-tooth spur gear, divide its number of teeth (86) by 3.9 to determine the correct pinion-gear size: 86 ÷ 3.9 = 22 teeth. Note: in this equation, you can use a spur gear of any size; simply divide its number of teeth by the desired pinion/spur ratio to find the right pinion size.

$$P = \frac{SG}{C1/C2 \times FD/TR}$$

$$P = \frac{86}{12.5/11 \times 7.53/2.19} = 22$$

Where: P—pinion gear; SG—spur gear; C1—circumference of truck's tire; C2—circumference of buggy's tire; FD—final drive ratio; TR—transmission ratio (internal).

Note: for the equation to work, you must know a proper gear ratio for the motor in question. This can be found by trial and error, or it may be supplied by the motor manufacturer. If you run trucks and want to know how to gear your truck motors for buggies, all you have to do is make C1 represent the circumference of the buggy tire and C2 that of the truck. Then work the equation using the truck's final drive ratio instead of the buggy's.

As a "dumping" precaution, work the equation to find a "ballpark" gear ratio, then start using a pinion gear that's one tooth smaller than the equation determined. ■

INDEX OF MANUFACTURERS

Aero-Car, P.O. Box 336, Western Springs, IL 60558; (708) 246-9027.

Airtronics, 11 Autry, Irvine, CA 92718; (714) 830-8769.

Associated Electrics Inc., 3585 Cadillac Ave., Costa Mesa, CA 92626; (714) 850-9337; fax (714) 850-1744.

Astro Flight Inc., 13311 Beach Ave., Marina Del Rey, CA 90292; (310) 821-6242.

Aveox, P.O. Box 1287, Agoura Hills, CA 91376; (818) 597-8915; fax (818) 597-0617.

Blue Thunder; distributed by Horizon Hobby Distributors, 3102 Clark Rd., Champaign, IL 61821.

Boca Bearing Co., 7040 W. Palmetto Park Rd., Ste. 2304C, Boca Raton, FL 33433; (800) 332-3256; fax (800) 409-9191.

Class Recreational Products, RD 1, Box 187A, Utica, NY 13502.

CRC, 6860 Stanwix Ave., Rome, NY 13440; phone and fax (315) 338-0867.

Du-Bro Products, 480 Bonner Rd., Wauconda, IL 60084; (800) 848-9411.

Dynamite, distributed by Horizon Hobby Distributors, 3102 Clark Rd., Champaign, IL 61821; (217) 355-9511.

Extreme Motorsports, P.O. Box 15903, Station F, Ottawa, Ontario, Canada K2C 2S8.

Hitec/RCD Inc., 10729 Wheatlands Ave., Ste. C, Santee, CA 92071-2854; (619) 258-4940; fax (619) 449-1002.

Hobbico, P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948.

Johhny Juice; distributed by Extreme Motorsports (see address above).

Kyosho/Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.

Lunsford Racing, 619 First Ave. E., Albany, OR 97321; (503) 928-0587.

MIP, 746 E. Edna Place, Covina, CA 91723; (818) 339-9008.

Orion; distributed by Peak Performance, 23352-J Madero Rd., Mission Viejo, CA; (714) 707-4683; fax (714) 707-4684.

Race Prep, 852 S. Hwy. 89, Chino Valley, AZ 86323; (602) 636-1955.

Reedy; distributed by Associated Electrics (see address above).

Rocket City R/C Specialties, 103 Wholesale Ave. NE, Huntsville, AL; (205) 539-8358.

RPM Inc., 14978 Sierra Bonita Ln., Chino, CA 91710; (909) 393-0366.

Sanyo, 2001 Sanyo Ave., San Diego, CA 92173

Schumacher Inc., 6302 Benjamin Rd., Ste. 404, Tampa, FL 33634; (813) 889-9691; (813) 889-9593.

Tamiya America Inc., 2 Orion, Aliso Viejo, CA 92656-4200; (800) 826-4922, (714) 362-2240.

Team Associated (see Associated Electrics above).

Team Losi, 13848 Magnolia Ave., Chino, CA 91710; (909) 465-9400.

Tecnacraft, 200 Meadow View Dr., Grayson, GA 30221; (404) 995-1560; fax (404) 995-1523.

Tekin Electronics, 940 Calle Negocio, Ste. 140, San Clemente, CA 92673; (714) 498-9518; fax (714) 498-6339.

Traxxas Corp., 12150 Shiloh Rd., #120, Dallas, TX 75228; (214) 613-3300.

Trinity Products, 1901 E. Linden Ave. #8, Linden, NJ 07036; (908) 862-1705; fax (908) 862-6875.

The Stuph; distributed by Tyler Industries, P.O. Box 1598, Wallingford, CT 06492; (203) 284-8311.

INDEX OF MANUFACTURERS

CHRIS' BACK LOT

A Leap of Faith

This is my page—mine!

The opinions expressed on this page do not necessarily represent the opinions of the entire *Car Action* staff. Any resemblance to reality is purely coincidental. Send your correspondence, hate mail, love letters, photographs—anything you like—to Chris's Back Lot, c/o RCCA, 251 Danbury Rd., Wilton, CT 06897.

A few definitions *(according to Chris)*

- **Parking-lot racing.** Racing designed to ensure that you can have fun anywhere—anywhere there's a free spot large enough to mark out a track, and a parking lot is perfect.
- **CCR (cost-controlled racing).** Races in which costly modifications are strictly controlled, so your car isn't obsolete and outclassed even before you buy it!

The industry has responded to the racing-for-all call! Tamiya, Bolink and Kyosho are to be commended not only for their foresight and creativity, but also for backing up their programs—Championship Series, Legend Series and R/C Sport Racing, respectively—with strong dealer support and incentives.

In these parking-lot (PL) programs, participants can race against a field of cars made by just one manufacturer, or they can just run what they brung against a varied field. There are advantages to both. By limiting a race to one manufacturer's vehicle, you create a very even field in terms of equipment.

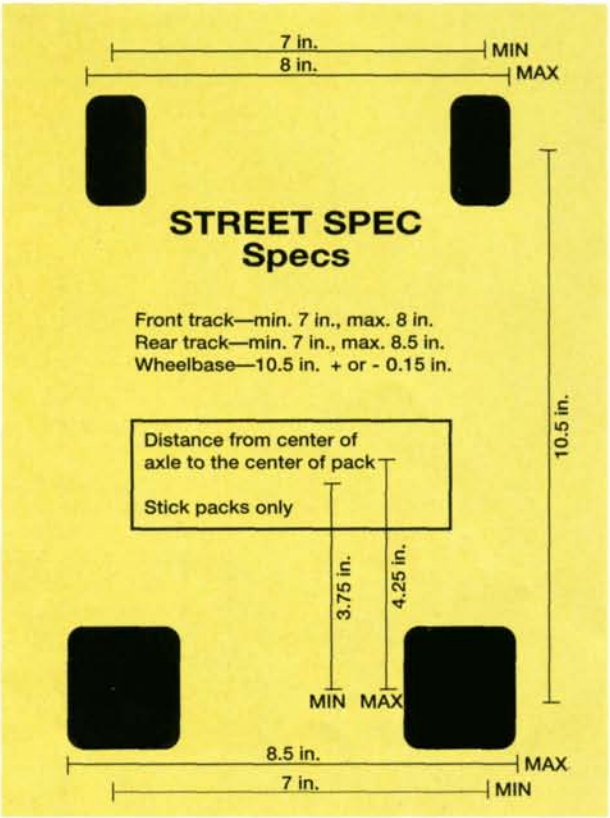
But this approach does have its downside. It excludes other companies from getting in on the racing. If the hobby is to remain vital and the industry is to remain strong, we need many players on the manufacturing team; and allowing vehicles from many companies to race against one another allows participants to show up with almost anything—within reason! But the "run-what-you-brung" approach has problems, too. Can you hear grouches shouting, "Hey! That's not fair, brand X comes standard with carbon-fresnell-tubes. Why can't I add them to my brand Z car?" "OK. But your brand-Z thing comes with a full-race dipstick. Why can't I add one to my brand-X rocket ship?" So what happens? Rules get changed and changed again till we're back to the spending escalation game. Enter Trinity's STREET SPEC program....

Like other CCR programs, central to Trinity's NASCAR/Sedan STREET SPEC racing are very tight controls on what racers can do to (spend on) their cars.

$$$???

• So how much will it cost?
—full kit with body: $165;
—full kit with body, motor and battery: $199.95.

It's like other PL programs except for one thing: all the R/C manufacturers in the universe are invited to produce equipment for it. All product submissions (two assembled kits, two unassembled kits and four of any other parts, including packaging) must be approved by Trinity and must reach them at least 30 days before they're to be used in competition. Manufacturers who send kits and parts will be notified in 10 working days (following the receipt of samples) whether they're legal for STREET SPEC racing.



So, what does Chris think of this? (not that anyone cares); well, the program seems to have been very well-thought-out. For example, a set of tires must not cost more than $9.95, and racers need carry only three sets in their pit boxes. So it will do fat-cat racers no good at all to show up at a race with 27 sets of tires. Only three will be allowed!

I'm not saying that the STREET SPEC is better than the other programs. They're all doing extremely well and, who can argue with success? I'm saying STREET SPEC is just different in that it not only offers racers a field of evenly matched cars, but it also offers the industry design and manufacturing guidelines so that an evenly matched field could also be a "multi-manufacturer" field. This may be good for smaller manufacturers who don't have the resources to start their own PL series, but would love to participate.

I'm not in the manufacturing end of this business, so I might be missing certain points, but Trinity's STREET SPEC program seems interesting, and we at *Car Action* are supporting it, as we support other CCR programs. There will be those who will embrace this offer with enthusiasm. To you, I offer our support as well. Then there will be those with a knee-jerk reaction of criticism. From those, I ask for a leap of faith.... ■